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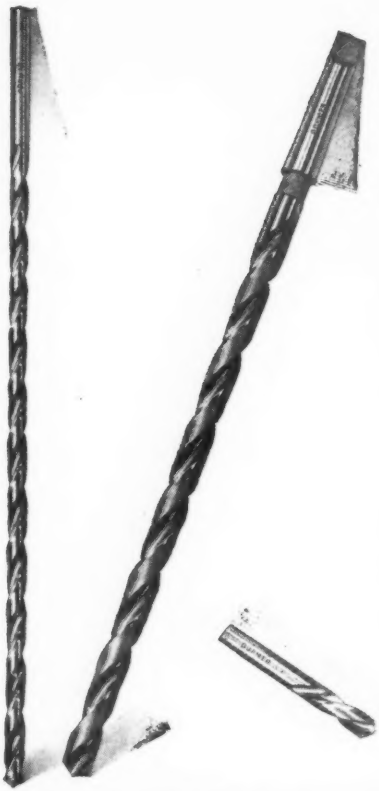
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Vol. 30, No. 5, May 1951

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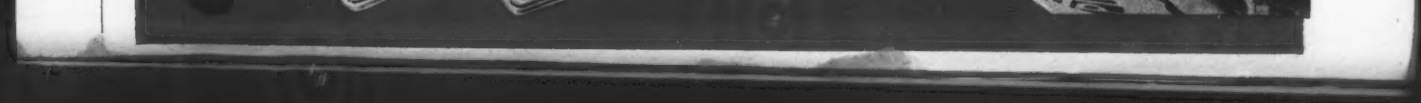
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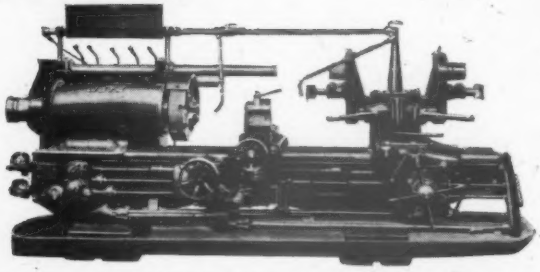
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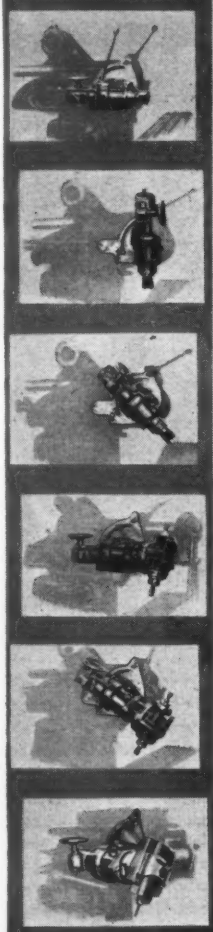
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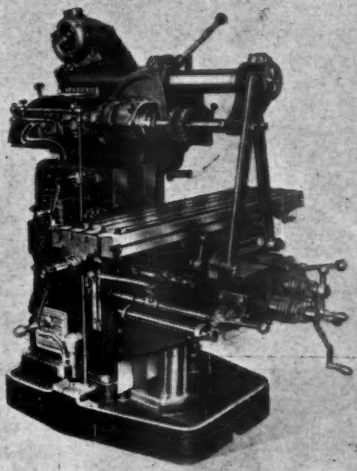
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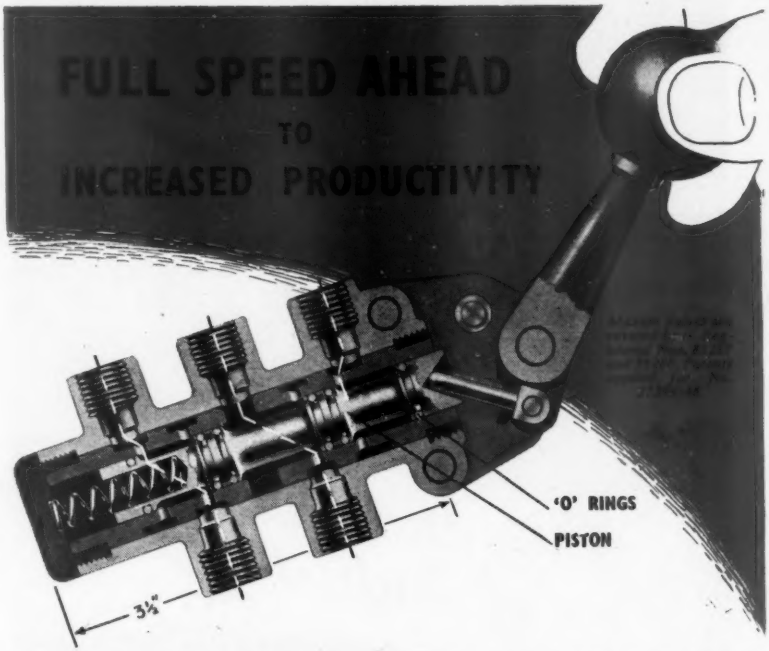
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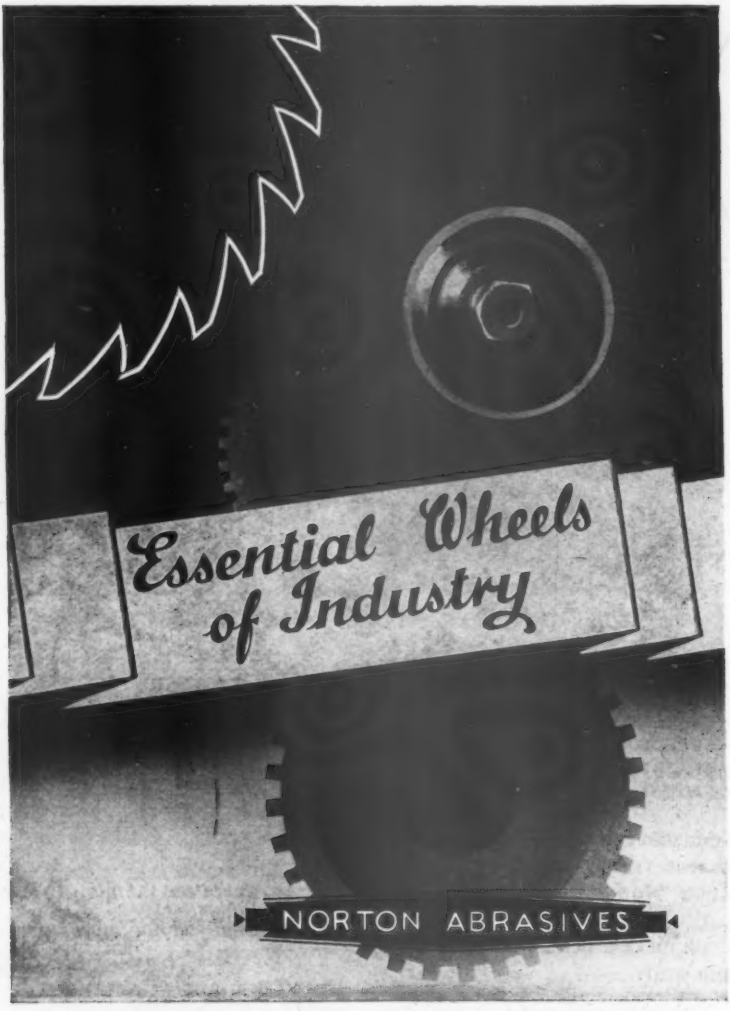
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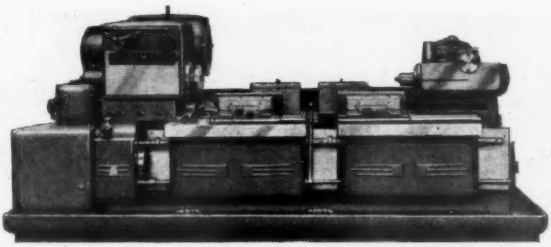
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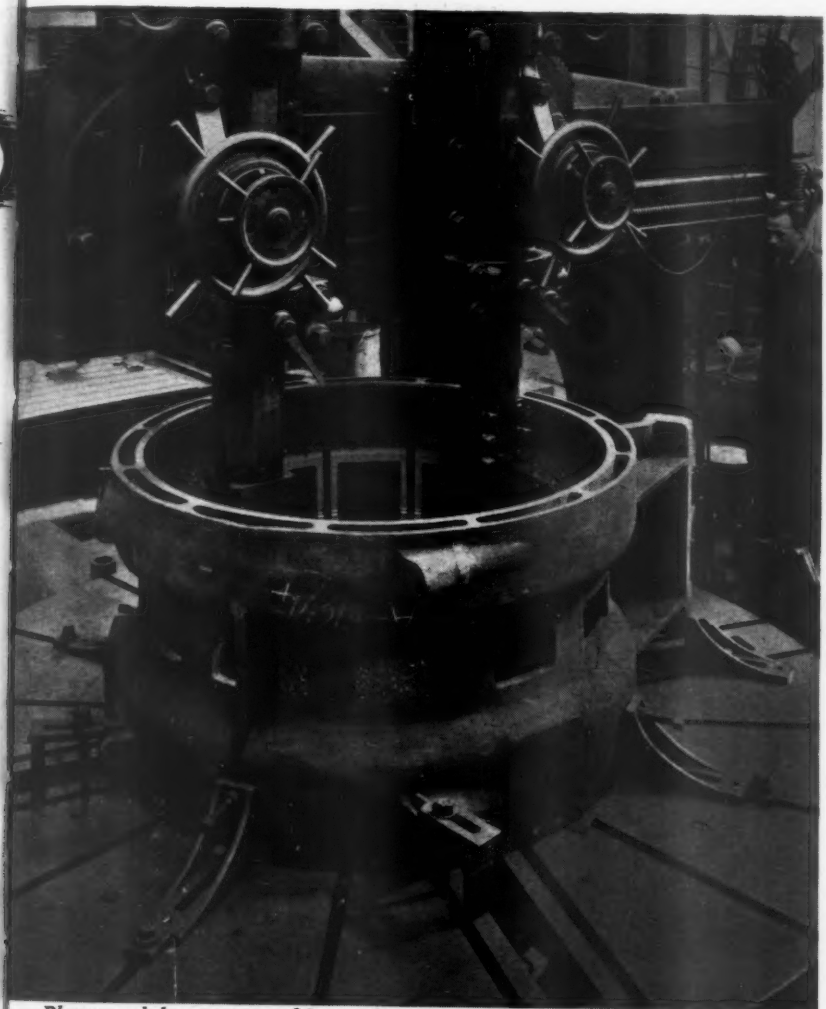
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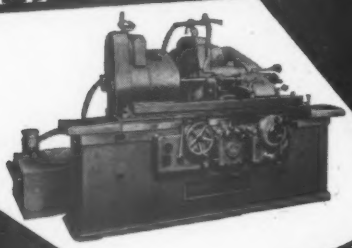
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SCHOFIELD SCHOLARSHIP AWARDS 1951

The Council is pleased to announce that the 1951 Schofield Travel Scholarships have been awarded to Mr. F. W. Walton, Chairman of the Liverpool Graduate Section, and Mr. A. H. Needham, a Graduate of the Lincoln Section.

Mr. Walton will spend six months in the United States of America, and Mr. Needham will visit Switzerland for six months.

In the case of the Swiss scholarship it has been possible this year to effect reciprocal exchange arrangements, and as a result a Swiss student will be travelling to this country to spend six months in industry here. The Institution has been able to put this scholarship on an exchange basis entirely because of the generous and far sighted action of a number of firms, both large and small, in which members of Council hold responsible positions. These firms have agreed to the placing of their names on a panel, and a certain number of them will be asked each year to accept a foreign student for a short period of training, and to pay him a subsistence allowance while he is with them.

It is the Council's hope that in future years it may be possible for both the scholarships to be arranged on an exchange basis, so that in addition to our young British engineers being able to get to know the people of other countries, young men from those countries will also have an opportunity of meeting British people through scholarship visits here.

THE SCHOLARS. The background of the successful scholars is as follows :—



F. W. WALTON

MR. F. W. WALTON, LIVERPOOL.

Mr. Walton, who is 26 years of age, was educated at Broad Square School and from there obtained a Liverpool Junior City Scholarship to the Quarry Bank High School. After 18 months employment with the Cheshire Lines Railway Company he attended the St. Helen's Technical College under the Engineering Cadetship Scheme, and was awarded the Diploma in Mechanical and Electrical Engineering.

On completion of the course he joined the Royal Corps of Signals, was commissioned and served in Egypt. He was released with the rank of

Lieutenant in 1948, after three years service.

In the same year he was granted a graduate apprenticeship with British Insulated Callender's Cables Ltd., and underwent an 18 months introduction to all phases of the firm's activities. During this period he undertook further studies in factory organisation and management, and was elected a graduate both of the Institution of Production Engineers and of the Institution of Mechanical Engineers.

On completion of his apprenticeship he was placed on the staff of the Telecommunications Cables Division at the Prescot Works of his company and is now responsible for all progressing, planning and raw material control in the telephone cable making department.

Whilst in the United States Mr. Walton will investigate the latest American techniques and the production methods used in the manufacture of paper insulated telephone cables.

MR. A. H. NEEDHAM, LINCOLN.

Mr. Needham is 27 years of age and was educated at the Bracebridge Council School before obtaining a scholarship to Lincoln School, at which he obtained the School Certificate.

At the Lincoln Technical College he obtained a Higher National Certificate in Mechanical Engineering, followed by a Higher National Certificate in Production Engineering. He then obtained an external B.Sc. (Eng.) of London University with honours, and is now a part-time member of the teaching staff of the College.



A. H. NEEDHAM

Mr. Needham served his apprenticeship with Messrs. Robey and Co. Ltd., of Lincoln. After serving in the drawing office, on outside erecting and in the iron foundry, he was appointed Assistant to the Senior Maintenance Engineer of the Company.

In 1950 he became Senior Maintenance Engineer with responsibility for the operation and maintenance of large steam and diesel prime movers, the overhaul and repair of machine tools, and all civil engineering works.

In addition to being a Graduate of the Institution of Production Engineers he is also a Graduate of the Institution of Mechanical Engineers.

Mr. Needham's project for study in Switzerland is concerned with production methods in heavy, non-repetitive engineering organisations.

INSTITUTION NOTES

May, 1951

BASIC PRINCIPLES OF FLOW PRODUCTION

The Birmingham Section of the Institution has given assistance to Birmingham College of Technology in organising a lecture-discussion course on "Basic Principles of Flow Production." The course, which commenced on 21st April last, has been arranged by the Industrial Administration Department of the College in consultation with the Birmingham Section, and is being given by Mr. Frank G. Woollard, M.B.E., Hon.A.C.T.C.(Birm)., M.I.Mech.E., M.I.Prod.E., M.S.A.E.

Mr. Woollard is widely known for his long experience in the engineering industry, much of his energy having been devoted to the introduction of flow production methods. He has made an extensive search for material to illustrate the series, which provides an opportunity to benefit from the concentrated essence of his experience.

The chair is being taken throughout the course by Mr. Harold Burke, Vice-Chairman of Council and President of the Birmingham Section of the Institution.

I.C.W.A. COST CONFERENCE

The Institute of Cost and Works Accountants announce that their 22nd National Cost Conference will be held at the Dorchester Hotel, London, on Friday, 1st June, 1951. The technical proceedings will be opened by the President, Mr. L. W. Robson, F.C.A., F.C.W.A., A.I.Prod.E., followed by a paper on "Accounting for Assets in Conditions of Changing Price Levels."

The afternoon session will deal with "The Cost Accountant's Contribution to Increased Productivity As It Affects (a) Top Management, (b) Production Management, (c) Shop Supervision." Papers will be given by Sir Charles Bartlett, M.I.Prod.E., Managing Director of Vauxhall Motors and Member of Council of the B.I.M., Mr. J. Hallifax, A.M.I.W.M., Production Superintendent of Hoover Ltd., at High Wycombe, and by a member of the Institute of Industrial Supervisors.

Members of the Institution will be welcome at the afternoon session, and also at the luncheon preceding it. Tickets for the latter, price 12/6, may be obtained from the I.C.W.A., 63, Portland Place, W.1., to whom application should also be made for lecture admission tickets.

B.S.I JUBILEE This year the British Standards Institution celebrates its Golden Jubilee, the original Engineering Standards Committee having held their first formal meeting in April, 1901. The General Council of B.S.I. has arranged to mark this historic event in appropriate fashion, and in addition to a number of social events, members of the Institution will be interested to learn that an exhibition, " British Standards—Fifty Years of Industrial Progress " will be held at the Science Museum, South Kensington, London, from 18th—29th June, when the contemporary benefits of standards, standardisation and simplification will be graphically presented.

MEMBERSHIP QUALIFICATIONS

1. STUDENTS Students who are considering applying for transfer to a higher grade of membership are reminded that they may obtain from the Head Office complete details of the present academic requirements for all grades of membership. In view of the recent change in the regulations they are advised to do this without delay.

2 GRADUATES Graduates who were elected or made application for election before the 1st September, 1950, and satisfied the Graduateship examination requirements or gained complete exemption from them, may be deemed to have satisfied the examination requirements of the Institution in all respects.

When they apply for transfer to the grade of Associate Member they may not be asked to undertake any other examination or part of an examination.

Graduates who were elected or applied for election after the 1st September, 1950 may, however, be required to satisfy certain subjects from Part III of the Institution's examination before they can be considered for transfer to Associate Membership.

NEWS OF MEMBERS

Mr. J. E. MacLaren, Member, Managing Director of B.S.A. Tools, Ltd., has been elected Chairman of the first Governing Body of the Birmingham College of Technology.

Mr. L. Dexter, Associate Member, is now Works Manager of Best Products, Ltd., Felix Works, Felixstowe.

Mr. P. Dunkley, Member, is now Manager, R.O.F., Maltby, Yorks.

Mr. R. F. Elliott, Member, has joined The Light Production Co., Ltd., Slough, as General Manager.

Mr. J. G. Gill, Associate Member, Consulting Engineer in Saint John, New Brunswick, Canada, is now President of Gill & Co., Ltd., and Vice-President of Forest Industries (N.B.) Ltd.

Mr. J. M. Martin, Associate Member, is now General Manager of Blackburn & Oliver, Ltd., Pemberton, Wigan.

Mr. S. L. Moon, Member, has joined Tube Investments, Ltd., as Joint Works Manager of Helliwell's Treforest and Aberdare factories.

Mr. R. W. McCreath, Associate Member, is now Assistant Dockyard Manager to the Singapore Harbour Board.

Mr. W. Powell, Member, is now Production Director of T.I. Cycles of India, Ltd., Madras, India.

Mr. H. W. Townsend, Member, has been appointed Production Control Manager, Hoover (Electric Motors) Ltd., Cambuslang.

Mr. R. P. Ball, Graduate, is now Estimating Engineer with Joseph Lucas (Gas Turbine Equipment) Ltd., Birmingham.

Mr. E. Perry, Graduate, has now joined the Production Study Department, R.O.F., Swynnerton, New Stone, Staffs, as Time Study Engineer.

Mr. S. E. Veness, Graduate, has been appointed Assistant to the General Works Manager, Marshall's Flying School, Ltd., Cambridge.

OBITUARY

The Institution records with very deep regret the death in hospital at Melbourne of Mr. Fred Glover, Member.

Mr. Glover was a founder member of the Melbourne Section eight years ago, and had served on the Section Committee and the Australian Sub-Council since their inception. He was Section Hon. Secretary in 1944, and Section President during 1945/47. In 1947, he spent some months in the United Kingdom and gave an address to Council, and also visited the Institution Section at Coventry, where he was born.

His wise counsel and willing co-operation were held in the highest regard, and will be sadly missed not only throughout the Melbourne Section, but by his many friends in the United Kingdom.

LIBRARY ADDITIONS

"Body Engineering" by Sydney F. Page, M.I.B.C.A.M., M.M.I.A., A.M.I.E.D. Chapman & Hall, Ltd., London. 24/- net.

"Joint Consultation." Institute of Personnel Management, London. 2/6d. net.

BRITISH STANDARDS

The following Standards have recently been issued and are available from the British Standards Institution, 28, Victoria Street, Westminster, London, S.W.1., at the prices stated :

781 : 1950—Wrought Iron Chain Slings (6/- post free).

1709 : 1951—Nomenclature of Drawing Instruments (2/- post free).

1812 : 1951—Cast Iron Economisers (2/- post free).

ABSTRACTS

(The following recent publications may be borrowed from the **Library.**)

331.15 INDUSTRIAL RELATIONS

"Communications within Industry" by R. W. Peters. *Harper Bros., New York.* 1950. *198 pages.*

The author is Chief Employee Relations Officer to a large American Oil Company, and as such some of the methods described will not be appropriate to British industry. He does, however, emphasise that production does not solely depend on machines and methods and that many efforts at increasing production are negatived by employees being left out of the picture. Points are made that the supervisor on the shop floor is the best distributor of information, and that better intercommunication between management and employee must come quickly if present pressure from without is to be combated.

331.152 CO-OPERATIVE ADMINISTRATION

"Industrial Democracy at Work : A Factual Survey" by W. Robson Brown, M.P. and N. A. Howall-Everson. *Sir Isaac Pitman & Sons, Ltd., London. 104 pages.*

A factual report in which the authors have collated their findings after making a comprehensive survey of the effectiveness of policies and methods in the operation of industrial democracy. Approximately 600 British industrial undertakings took part in the survey covering most of the main factory industries, and large, medium and small units in each.

The book is arranged in five sections and covers such main activities as, Joint Consultation, Co-partnership, Profit-sharing, Training for up-grading, etc., together with a summary of the authors' conclusions. Much of the information is conveniently tabulated and a specimen copy of the questionnaire sent to the industrialists is appended.

"Joint Consultation over 30 Years (A Case Study)" by Sir Charles G. Renold. Foreword by Sir Clive Baillieu. *George Allen & Unwin, Ltd., London. 195 pages.*

This book is a case study of joint consultation in a manufacturing engineering organisation over a period of more than 30 years, during which time the number of personnel employed rose from 1,000 to 6,000. It describes fully the evolution of a management organisation and joint consultative procedures, and enumerates various problems which have to be faced by management during such a period of organisational change. Some typical problems handled by joint consultation are given in illustration, and an analysis is made of the lessons learned during the 30 years under review, with the conclusions which may be drawn from them.

The text is illustrated with organisational charts and the constitutions of committees, sample minutes, and other documents are given as appendices.

669.14 STEELS

"Heat Treatment Fundamentals" by S. Collard Churchill. (Yellow Back Series No. 26). *The Machinery Publishing Co. Ltd., London. 66 pages.*

This booklet details in non-academic terms the changes of structure in carbon steels and considers mass effect and alloying. Normalising and tempering and modification of grain size are followed by "S" curves illustrating the transformation of austenite in such processes as austempering and martempering. The booklet concludes with sub-zero stabilising and various methods of carburising.

658.5 WORKS MANAGEMENT

"Works Management and Organisation" by P. S. Houghton, A.M.I.Mech.E. *E. & F. N. Spon, Ltd., London. 270 pages.*

Between the covers of this book, the author has endeavoured to say something about every aspect of works management and organisation,

from showing visitors around the works to time study, from the allocation of time-clock numbers to the various systems of incentive payment. Because of the vast range of subjects dealt with, the treatment of any one subject is not exhaustive, by any means. Nevertheless, any student of management who wishes for a concise survey of the many activities included in works management will find an introduction to any particular activity within this book.

The author states, in his preface, that this is a compilation of existing material brought up to date and supplemented with additional information from his own experience. A bibliography and an index are included

THE LIBRARY The Library will be open between 10 a.m. and 5.30 p.m. on Mondays, Tuesdays, Thursdays and Fridays; between 10 a.m. and 8 p.m. on Wednesdays; and between 10 a.m. and 1 p.m. on the first Saturday of every month.

JOURNAL BINDERS Members are reminded that binding cases for the Journal are obtainable from Head Office, price 7/6 each post free. The cases, each of which will hold 12 issues of the Journal, are made of stiff board covered with imitation leather cloth, with gilt lettering on the spine.

CHANGE OF ADDRESS It would be of great assistance to Head Office if members would ensure that the business addresses contained in their records were up-to-date, and would notify Head Office as soon as possible of any change of appointment.

RESEARCH PUBLICATIONS A number of copies of the following Research publications are still available to members, at the prices stated :

Report on Surface Finish, by Dr. G. Schlesinger	15/6
Machine Tool Research & Development	10/6
Practical Drilling Tests	21/-
Test Charts for Machine Tools, Parts 3 and 4	5/6 each

These publications may be obtained from the Production Engineering Research Association, "Staveley Lodge", Melton Mowbray, Leics.

ISSUE OF JOURNAL Owing to the fact that output has to be adjusted to meet requirements, and in order to avoid carrying heavy stocks, it has been decided that the Journal will only be issued to new Members from the date they join the Institution.

IMPORTANT In order that the Journal may be despatched on time, it is essential that copy should reach the Head Office of the Institution not later than 40 days prior to the date of issue, which is the first of each month.

SECTION MEETING

The following meeting has been arranged to take place in June, 1951.

19th **Wolverhampton Graduate Section.** A lecture on "Industrial Economics" will be given by C. Tragen, Esq., M.A. (Oxon), Dip.Econ.Pol.Sc. (Oxon), at the Wolverhampton and Staffs Technical College, at 7.30 p.m.

TRENDS IN COAL PRODUCTION METHODS

by D. DOUGLAS, B.Sc., M.I.Min.E.*

Presented to the West Wales Sub-Section of the Institution, 8th December, 1950

THE object of this paper is to present a general, rather than technical, description of the methods and machines employed in the mining industry in Great Britain for the basic operations of breaking down and loading coal at the coalface. The complementary face operations of packing and support, road formation, etc., which often condition the application of a particular machine or method, are beyond the scope of the paper, as also are technical details of the machines to which reference is made. Although every effort has been made, it has not been possible to avoid the frequent use of mining terms.

APPLICATION OF MATERIALS HANDLING

The problems involved in the operations described are largely those of materials handling—a sphere in which great strides have been made in industry generally in recent years. The progress made in coalmining in the development and application of mechanical handling, though perhaps less spectacular, is, having regard to the limitations imposed by conditions underground, no less marked than that achieved in most other industries.

The methods and machines which are employed for breaking down and loading coal at the face differ to some extent according to the system of mining adopted. Some brief description of the principal systems of mining may, therefore, be desirable.

SYSTEMS OF MINING COAL

There are two main systems of laying out the workings for the underground mining of coal, namely, Room and Pillar, and Longwall. In the Room and Pillar system relatively narrow " rooms," roadways or headings are driven in the seam according to some pattern to form pillars of coal. The pillars may afterwards be extracted completely or partially, as conditions permit, or they may be left intact to provide support for the surface and/or the workings.

In the Longwall system the whole of the coal is extracted over a relatively wide wall or face. In the common application of this system, namely, Longwall Advancing, as the coal face advances the roadways for haulage, ventilation and other services are formed and maintained behind it in the adjacent strata.

* Area General Manager, No. 1 Area, South Western Division, N.C.B.

There are numerous modifications and combinations of these systems. For example, in Longwall Retreating, which is a combination of the two systems, narrow roadways or headings are driven to form large pillars. These pillars are then extracted by bringing back a longwall face towards the origin of the headings.

Room and Pillar, the older of the two systems, was evolved when thick and moderately thick seams were available at shallow depths. In such conditions the pillars provide support for the roadways without undue crushing ; the amount of ripping required to be done in stone to make and maintain roadways of adequate dimensions may be small and the proportion of unproductive labour is reduced to a minimum. In deeper seams it is usually found that, due to the effects of pressure, the disintegration of the strata around roadways formed in pillars is excessive and it is difficult, and often economically impossible to maintain them in serviceable condition. Furthermore, the pillars become crushed and difficult to extract. In these circumstances, the Longwall Advancing system has advantages compared with the Room and Pillar system. It is also more adaptable to the working of thin seams.

For many years natural and operational conditions in the majority of British coal mines have generally required the application of the Longwall system. The tonnage of coal mined with the various systems in Great Britain in 1948 is given in Table 1. At the present time about 86 per cent of our output is mined by Longwall.

TABLE I.

DEEP MINED COAL PRODUCTION 1948*

System of Mining	Coal Raised and Weighed 1,000 tons	% of Total
Longwall—Advancing ...	176,525	82·6
Longwall—Retreating ...	5,568	2·6
Room and Pillar	28,217	13·2
Other systems	3,467	1·6
TOTAL	213,777	100·0

*M.F.P. Statistical Digest 1948 and 1949.

The Technical Advisory Committee appointed by the Minister of Fuel and Power in 1944 " to examine the present technique of coal production from the coal face to wagon, and to advise what technical changes are necessary in order to bring the Industry to a state of full technical efficiency " recommended† that the Room and Pillar system be adopted as first choice where conditions are favourable for full mechanisation. They also recommended the



The A.B. Fifteen Longwall Coalcutter leaving the roadhead.



A.B. Fifteen Coalcutter, fitted with Propeller Gummer, at work underground.

application of Longwall Retreating in preference to Longwall Advancing where conditions permit. These alternatives to the Longwall Advancing system have been given much attention in this country during the past ten years.

Where conditions are favourable to its application, the Room and Pillar system is capable of yielding a higher output per manshift than other systems with present-day equipment and techniques. It is more or less standard practice in the U.S.A. where operations are highly mechanised and output per manshift, by European standards, is high.

† Report of The Technical Advisory Committee on Coal Mining, Ministry of Fuel & Power 1945.

AMERICAN METHODS

An investigation of American mining methods carried out by British mining engineers early in 1942 indicated that, with operations fully mechanised, there was a greater scope for the application of the Room and Pillar system in British mines than had been realised up to that time. But subsequent large scale attempts to extend the application of the Room and Pillar system in British mines with American-type machines have met with little success, chiefly because geological conditions have proved unsuitable.

Longwall Retreating with modern techniques for driving the narrow headings would appear to offer scope for securing some of the advantages of both the Room and Pillar and Longwall Advancing systems, especially in seams where conditions are marginal for the application of either system. Interest in Longwall Retreating is increasing, but the system is thought to have only limited application due to the excessive effects of pressure on the narrow headings.

Under the urge for increased productivity every possible alternative will be explored and developed but, with the inevitable trend towards deeper mining and the working of more and more thin seams, it is probable that the greater proportion of British coal output will continue to be mined by the Longwall Advancing system.

METHODS OF GETTING COAL

The application of machinery to the operations of breaking down, loading and transporting coal at the working face has engaged the attention of engineers for nearly two centuries, but it is only since the First World War that any significant advance has been made. The progress made in coal face mechanisation has been chiefly in the application of coal-cutting machines and conveyors. Table II shows the rate and extent of the increase in the proportions of total output mechanically cut and conveyed in Great Britain between 1920 and 1949.

TABLE II.

PERCENTAGE OF OUTPUT MECHANICALLY CUT AND CONVEYED

Year	% of Output mechanically cut.	% of Output mechanically conveyed.
1920	13·2	Not available
1930	31.0	17·0
1935	51·0	43·0
1940	63·7	61·1
1945	72·2	71·0
1949	78·0(approx.)	82·0(approx.)

This steady but substantial increase in the use of coal-cutters and face conveyors has been made possible by the evolution in design of the machines themselves, improvement in methods of roof control, the development of conveyor transport on roadways and technical advances in other branches, such as power transmission and coal preparation.

DEVELOPMENT OF THE COAL-CUTTER

The evolution in design of the coal-cutter has led to machines which can be applied in a wide variety of seam conditions and to both the Room and Pillar and the Longwall systems of mining. Machines as low as twelve inches in height for use in thin seams ; machines for cutting at different horizons in the seam between the floor and the roof ; machines which can make both horizontal and vertical cuts for use in narrow workings, are all standard. Special types, e.g., machines which make two parallel cuts simultaneously for cutting out thick dirt bands, are also available.

The trend of design has been towards the chain type of machine in which the cutting member or jib comprises a high speed chain fitted with readily changeable pick points. The standard jib makes a cut in one plane only, but experiments are proceeding with curved jibs, which make a horizontal and a shearing cut at the same time with the object of helping to break down the coal after cutting and reducing shotfiring.

The cut is generally made at floor level, either in the bottom few inches of the seam or in soft shales below it. Machines for cutting at other horizons have long been standard and more attention is being given to their application for cutting out dirt bands in otherwise good seams or for better preparation of the coal for loading. Where the stone above the seam is weak and friable, the cut may be made slightly below the top of the coal thus leaving a layer of coal to form a stronger roof.

Mechanical conveyors were applied at the face in the Longwall system to increase the length of face between roadways and thus reduce the amount of unproductive work required in their making and maintenance; to concentrate producing operations into smaller areas of workings and to reduce the manual labour involved in loading.

TYPES OF CONVEYOR

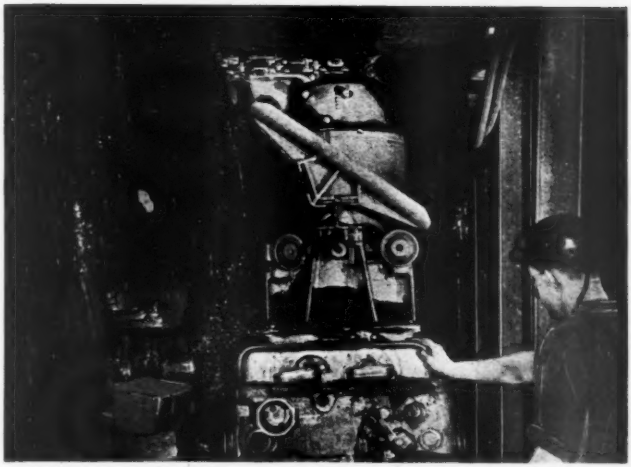
The chain type of conveyor was among the first to be introduced, followed by the shaker and later the rubber belt conveyor. These are still the principal types used. The rubber belt conveyor is by far the most popular type in Longwall mining, although both the chain and shaker types are also widely used. The tendency is for shaker conveyors to be replaced by one of the other types. On the other hand, there has recently been a revival of interest in the chain conveyor for face work in Longwall. It can stand up to rougher usage than belts and tends to give a better performance when starting up under overload. The development of "continuous-mining," referred to later, will undoubtedly lead to the increasing use of special types of chain conveyors.

In Longwall mining the face conveyors have to be moved forward frequently. The rows of props set for support prevent this being done without dismantling the conveyors and sectional construction, to permit easy dismantling and re-erection, is therefore an essentia feature of design. To facilitate man-handling in restricted space the sections have to be light and compact. Similar considerations apply to conveyors for Room and Pillar work since these have to be extended frequently.

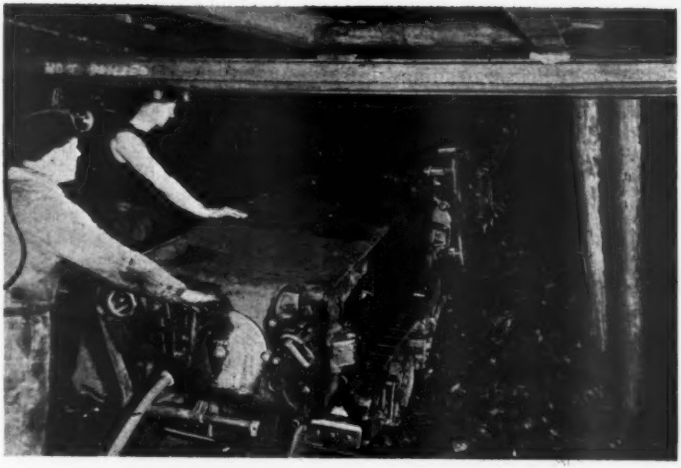
All coalface machinery is powered either by electricity or compressed air. Because of its greater efficiency the trend is towards the greater use of electricity but compressed air will be retained where necessary for reasons of safety.

As cutters and conveyors became established in Longwall mining, there was a trend in the direction of obtaining the maximum performance by the machines. As the machines improved, the trend was towards longer faces and deeper cuts. Factors other than the machines themselves, e.g., roof control, ventilation, haulage, etc., have to be considered, however, and present practice tends towards an optimum length of face according to all the circumstances. Generally the length of face has become stabilised between 100 and 150 yards for single units, and between 200 and 300 yards for double units, while the depth of cut is commonly between 4 ft. and 6 ft.

Nearly 70 per cent of present output is cut by machine and hand-loaded on to conveyors—the majority in Longwall mining.



A.B. Fifteen Hydraulic Turret Overcutter cutting 7 ft. up.



A.B. Dreadnought Arc-Shearer making a shearing cut.

Longwall working with cutters and conveyors may, therefore, be regarded as the conventional British method of mining coal.

In this form of Longwall machine mining a fairly rigid cycle of operations is necessary. Coal filling requires a separate shift. Packing, dismantling and re-erecting conveyors, withdrawing supports, ripping, cutting and other work require two shifts, leaving one shift in three for coal filling. The cycle adopted is commonly one of 24 hours, all the various operations being completed in three consecutive shifts. Each operation must follow in its proper sequence, and a delay or breakdown in any one of them may upset the whole cycle and result in serious loss of output.

Separate teams of men are employed for each of the various operations, one team getting and loading, another turning the conveyor, another packing, and so on. The method thus involves a high degree of specialisation and on this account lacks flexibility.

POWER GETTING AND LOADING

The development of mechanical cutting and conveying, and concurrent improvement in machines and techniques for blasting or otherwise breaking down the coal to loadable sizes, naturally focused attention on the application of machines for loading.

The first successful machines of this type were developed in the early 1930's in the U.S.A. where the proportion of output loaded by them increased fairly rapidly. These machines were designed for use in the narrow roadways which are a feature of the Room and Pillar system. As applied in the U.S.A. they speeded up the work of development by headings and the subsequent pillar extraction, thus making it possible to obtain large outputs from concentrated workings with high productivity.

Although fairly extensive trials have been carried out in this country, it is considered that these American-type machines have only a limited field of application for coal loading in British conditions. Some types have, however, been adapted for the heavier work of loading stone and these are being used in increasing numbers in stone drifts or tunnels. To the extent that Longwall retreating is adopted these machines may be applied increasingly for the development work by narrow headings.

In Great Britain efforts have been concentrated on the development of loading machines for use in Longwall mining, and several practical designs have been produced. They have not been applied to any appreciable extent, although one type has achieved some success and is giving good results in a limited field. These machines require loose and broken coal for their efficient operation and this involves cutting and blasting the coal ahead of the loader. The saving in manpower is thus limited to the difference between the



Joy 11—B.U. Loader underground.

number required for hand loading and the number required on the loader.

Interest in loading machines has been diverted by the comparatively recent development of machines which both break the coal away from the solid face and load it on to conveyors or other forms of mine transport. These machines perform simultaneously the four operations represented in conventional methods by cutting, drilling, blasting and loading. The saving in manpower is thus much greater than that possible with machines which only load.

The most successful machine of this type in use in this country at the present time, the "Cutter-Loader," is of British design and manufacture. This machine is essentially a high-powered coal-cutter, fitted with three cutting jibs, in which a loader unit is coupled to the cutter unit. Two of the jibs make horizontal cuts in the seam, one at floor level and one at some other horizon while the third jib, which is attached to the loader unit, makes a vertical shear cut at the back of the horizontal cuts. Where the natural cleavage planes in the seam are favourable these multiple cuts are sufficient to break up the coal to loadable sizes. The broken coal falls on to the loading unit, consisting of a short conveyor which, in turn, delivers it on to the face conveyor.

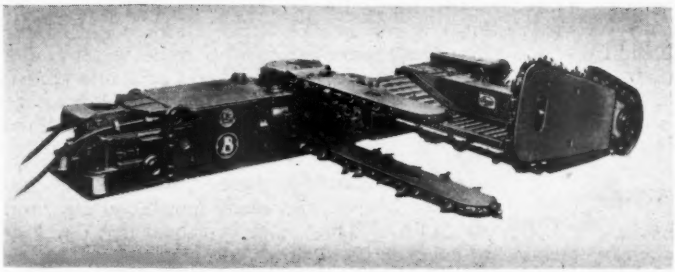
This machine, in its present form makes a horizontal cut of at least four feet and therefore exposes a wide span of roof. This has to be supported immediately behind the machine by a row of props and bars set between the conveyor and the newly exposed coal face. To advance the conveyor into the new track thus formed, it has to be dismantled and the sections passed between the props and re-assembled. This work usually occupies one shift and the packing, ripping and other work require another shift, as in the conventional method. Operations are thus cyclical and coal production is usually restricted to one shift in three.

Two rather similar machines equipped with cutting jibs making horizontal and shear cuts, but with which the depth of cut may be as shallow as two feet, are now available and undergoing trials. These machines are more compact than the one previously described. Their narrow width permits both the machine and conveyor to work between the front row of props and the face. The conveyor can, therefore, be advanced bodily to its new track by means of power-operated rams or hand-jacks in a matter of minutes, and can thus follow up the getting and loading machines immediately a cut is taken off the face. This method of applying these machines permits mining to be carried on continuously, but the method introduces special problems of roof control since the span of roof exposed between the front row of props and the face is wider than it is in cyclical mining.

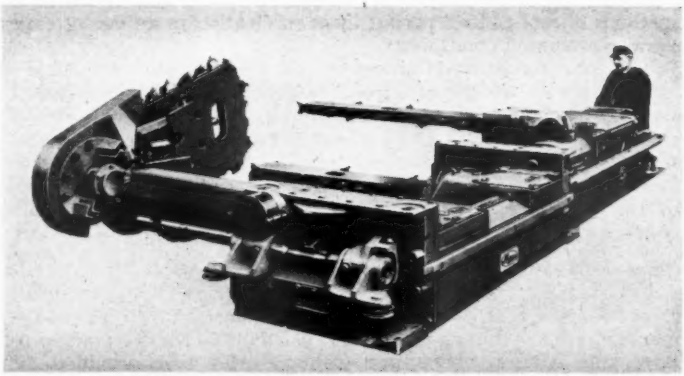
THE "STRIPPER" Another British getter-loader machine, recently developed and now undergoing fairly extensive trials, utilises an entirely different principle for breaking down the coal. Whereas the machines already described depend upon cutting jibs this machine, the "Stripper," employs the principle of the wedge for its action.

The machine shears a strip of coal about two feet wide off the face by means of hydraulically driven wedges, the hydraulic power being supplied by an electric motor. As the machine advances the broken coal is forced over a ramp forming the base of the wedge ahead, and deflected on to the conveyor. This machine also permits continuous mining and since the conveyor is advanced close up to the face as consecutive strips are taken off, the span of roof not supported by props may be less than it is with the machines previously described.

When the coal is too hard for the successful operation of this machine alone, in its present form it may be used in conjunction with a coal-cutter. The cutter is mounted on the conveyor, which must be of special type, and makes a shallow cut to ease the work of the "Stripper" in breaking down the coal.



A.B. Meco-Moore Cutter Loader—low type viewed from face side.



A.B. Meco-Moore Cutter Loader—low type showing loader discharge and shearing jib mounting.

The wedge principle was adopted in a machine evolved in Germany during the last war, also for continuous mining. In this case the wedge is pulled to and fro along the face by means of rope haulage and shears off a strip of coal less than one foot wide. This machine was developed for working in soft coals, and experiments are proceeding to determine how far it can be applied in British conditions.

A special type of chain conveyor has been designed for use in conjunction with these machines for continuous Longwall mining. Its essential features are its heavy structure, a degree of flexibility and its ability to run satisfactorily with a bend somewhere in its

length. These features allow the work of moving forward the conveyor and setting the new line of supports to proceed closely behind the Getter-Loader. This enables supports to be set earlier than when the standard type of conveyor is used, and thus contributes to the solution of roof control problems. A further advantage is the reduction in the time interval between consecutive runs of the Getter-Loader.

CONCLUSION

The trend in British coal production methods has been progressively towards power-getting and loading in Longwall mining. The comparatively recent development of machines which both break down and load the coal at the face marks an important advance in this branch of mining technique. Progress in the application of these machines has so far been slow, but may be expected to accelerate as the development of new machines, the modification of existing types, and improvements in methods of roof control permit their application to an ever greater variety of mining conditions.

The most recent trend is towards the development of machines and techniques which permit continuous mining. If these can be successfully developed and widely applied, they offer a means of raising face productivity above that obtainable with conventional methods. At present, however, these machines and methods seem more likely to be successful in the easier conditions and a solution to the problem of power-getting and loading in more difficult conditions has yet to be found.

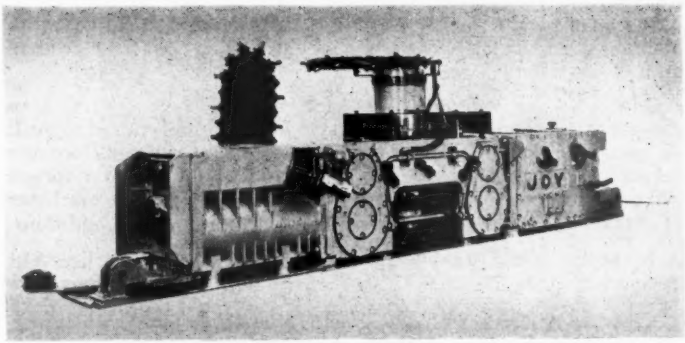
Acknowledgments

I gratefully acknowledge the assistance given by colleagues in the preparation of this paper. I also wish to record my thanks to the manufacturers of mining machinery, particularly Messrs. Anderson-Boyes and Messrs. Mavor and Coulson, who have provided the slides and sound films used in the presentation of this paper, the films showing the A.B. Meco Moore Cutter Loader and the M. and C. Samson Stripper at work underground.

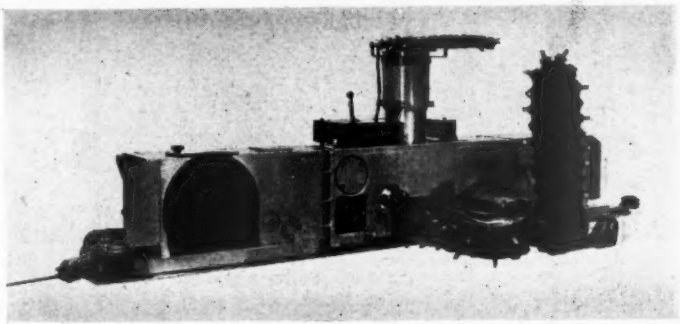
DISCUSSION

THE CHAIRMAN complimented the author on the paper and films. He thought that other industries might well copy the manner in which the films had been made.

In referring to the heavy capital cost involved in the installation of the machines and the problems of maintenance, the Chairman asked what steps had been taken to see that the machines were properly protected to prevent dust affecting the bearings, etc., also whether the blades of the wedges on the Stripping Machine were tipped with any particularly hard metal to prevent excessive wear.



Joy Gloster Getter Cutter Loader



Joy Gloster Getter Cutter Loader viewed from face side.

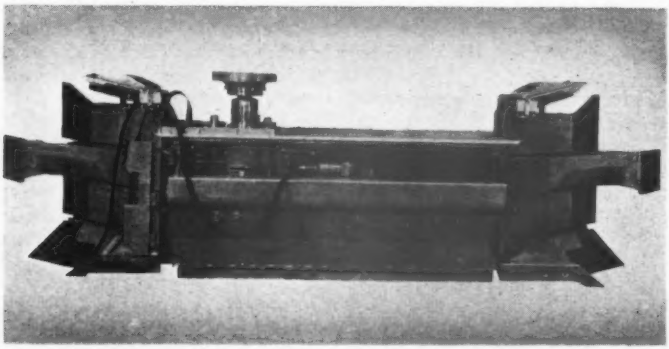
MR. DOUGLAS said that the capital cost involved was heavy but as, in the Coal Industry, wages formed approximately two-thirds of the total cost of production, this was justified if it was possible to reduce labour or make labour more productive. With regard to maintenance, special care was taken in the design of the machines to exclude dust and generally performance was satisfactory. With regard to tipping of the wedges on the Stripper, it was a question of balancing the cost of renewing against using expensive tipping materials.

MR. TREVOR HARRIS. Why had these machines, especially the Meco-Moore Loader, which was developed about 1932, not come

into a great deal of use until fairly recently? Also, how did British methods compare with modern Continental methods in the production of coal?

MR. DOUGLAS. Since the prototype of the Meco-Moore had been designed in the middle 1930's, it had been completely redesigned. A good deal of pioneering work had been necessary before the present design was evolved. The limitations imposed upon its use were chiefly those of mining conditions. The use of these machines is restricted to what in British mining are relatively good conditions.

In reply to the second question, British mining practice had proceeded along traditional lines in the application of conveyors



Mavor & Coulson Samson Stripper, general view.

with coal cutters. On the Continent parallel development had taken the form of conveyors with pneumatic picks.

MR. W. A. DAVIES. How had productivity been affected by the fact that the percentage of coal mechanically cut and conveyed had increased?

MR. DOUGLAS. The increase in the proportion of output mechanically cut and conveyed had meant a considerable reduction in manual labour and O.M.S. might have been expected to show some proportionate increase. Up until 1935/36 this was actually the case. Since that time this trend had been offset but not necessarily due to the failure of the method or the human element. The machines had been applied in increasingly difficult conditions. It was clear that although, in total, the O.M.S. had not shown much



Mavor & Coulson Samson Stripper at work underground.

increase, if the machines had not been applied, O.M.S. would have been much lower.

MR. C. E. CLOUDSDALE. What steps had been taken to make miners mechanically minded?

MR. DOUGLAS. Various methods had been adopted by various Companies but since 1943 fairly elaborate schemes of training had been embarked upon. Training Centres had been set up in Sheffield since 1941/42, where employees particularly concerned had received an initial period of training of six months in the operation and maintenance of various types of machines. Since nationalisation opportunities for training had very much improved, and apart from the Centre at Sheffield each Division had special training arrangements.

MR. W. F. S. WOODFORD referred to the dust caused by the operations, as shown on the film, and asked what effect increased mechanisation had on the health of the workmen, particularly with regard to silicosis.

MR. DOUGLAS. The film referred to was about five years old, and since then methods had been developed for suppression of dust on these machines. Dust danger was becoming increasingly recognised and in the machines as they are now applied, each of the cutting units carried two sprays of water. These and other sprays used in conjunction with machine mining did effectively suppress dust.

With regard to the "wedge" machine (the Stripper), experi-



Mavor & Coulson Samson Stripper.

ments are being made and in the fairly near future effective spraying devices would no doubt be incorporated in the machines.

MR. REES DAVIES. What proportion of the total output was at present produced by power getting and loading?

MR. DOUGLAS. In 1949 the proportion of total British output got and loaded by power machines was 3·6 per cent. For 1950 the proportion would probably have increased by another 1 per cent. About 1·6 per cent of the total national output produced in 1949 was obtained by the Meco-Moore Loader.

MR. TREVOR HARRIS. Were the Board taking steps to ensure that

the product under machine mining was as clean as the coal produced prior to mechanisation?

MR. DOUGLAS said that in some circumstances there was increased dirt in the coal produced, and therefore the quality of the product would depend upon the efficiency of the preparation plant at the Colliery. The National Coal Board had a large programme in hand for the installation of cleaning plants and he thought it would not be very long before that programme would be in step with the pace of increased mechanisation.

MR. W. F. S. WOODFORD moved a vote of thanks to Mr. Douglas. He felt that the paper was a suitable one for reading before the Institution, as without coal there would be no production of any kind. Further, a paper on coal production was in line with the Institution's general policy of setting a high standard for their members to enable them to practise their profession. Production was not confined to metal cutting and principles of production as adapted in the Mining Industry could readily be applied to many other industries. The paper was a valuable contribution to the Proceedings of the Institution. On behalf of the members he expressed appreciation and thanks for the paper and the work which had been put into it.

MR. DOUGLAS thanked those present for the reception given to the paper and the remarks made thereon. He had been glad to have the opportunity and hoped the paper would be of some value to the members of the Institution.

NATIONAL STANDARDISATION AND PRODUCTIVITY

By Dr. E. L. DIAMOND, M.Sc., (Eng.), M.I.Mech.E.*

Presented to the Eastern Counties Section of the Institution, 15th September, 1950

THE publication last year of the Report of the Committee for Standardisation of Engineering Products (the Lemon Committee), appointed by the Minister of Supply, and of the report on Simplification in Industry by the Anglo-American Council on Productivity has focussed attention on the subject of standardisation to a greater extent than ever before. The Report is itself the outcome of a general realisation that in the nation's present economic difficulties, standardisation is an aid to increased productivity which we cannot afford to neglect. At a time like the present when the productive capacity of the country is stretched to its utmost, some of the arguments against standardisation heard in the past have lost their force. Whilst the very different conditions prevailing during the industrial fight for survival in the " thirties " are by no means forgotten, the great advantages of judicious and carefully planned standardisation have been brought home to everyone so forcibly at the present time that few are now inclined to question the main recommendations of the Lemon report.

PLANNING IN THE FACTORY

The Lemon report recognises that its recommendations affect planning in the actual factory, as well as the work of the British Standards Institution. The following two recommendations make this clear :—

(*a*) Individual firms and sections of industry, both producers and users, should specialise and simplify the range of products which they manufacture or use as far as circumstances allow.

(*b*) The production of national standards of wide applicability should be extended and speeded up. To this end all sections of industry should urge forward the work of the B.S.I.

The implications of the first recommendation were very fully discussed at a recent meeting of the Institution of Mechanical Engineers at which a paper by Dr. H. E. Merritt was discussed. This paper bore the title " Simplification Creates Problems For Top Management," and was indeed so exclusively concerned with

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the simplification of products within the individual factory, that it did not so much as mention the British Standards Institution.

Certainly the individual organisation can go very much further with simplification than can a committee of the B.S.I., or perhaps it would be more accurate to say that it can extend simplification to much more complicated products than can be dealt with nationally. National standardisation of basic components and intermediate products is, however, the essential foundation for full simplification within any organisation if the full advantages in the cost of manufacture and of subsequent maintenance of the end product are to be realised. It is very largely with this aspect of the matter that this paper will be concerned.

ADVANCE OF SPECIALISATION

Specialisation has today proceeded so far that a large proportion of individual manufacturing organisations are either occupied mainly in making intermediate products or in assembling them. Many firms manufacturing machinery of one kind or another, or even large process works with engineering plant to maintain, have turned their attention to the list of components held in store in order to reduce them to a minimum.

Considerable economies have been made in this way by reducing the capital value of the stock in hand, and the space and labour entailed in handling and keeping record of the components. The economies to be achieved by this means are often indeed so great that managements sometimes overlook the fact that local action of this kind can seldom have any great effect on the price of the component bought out.

An interesting case recently came to the author's notice where a large manufacturing firm had standardised a simplified range of brass pipe fittings. The fittings hitherto stocked had varied dimensionally according to the firm supplying them, each supplier having his own standard in the absence, so far, of a British Standard. It was not practicable to confine purchases to one supplier, and the standard range decided upon was, therefore, " special " to each supplier and actually commanded a higher price than the fittings hitherto supplied. The savings attained within the firm's own organisation by the drastic reduction in the variety and number of fittings held, greatly outweighed the extra cost, which was, therefore, regarded as a profitable investment.

From the national point of view such an individual approach to simplification, whilst yielding wholly useful results, does not contribute greatly to increased productivity and reduced manufacturing cost of the component itself, since even if other large buyers took similar action the chances are, in the absence of national

co-ordination, that each would select a different standard range and the total number of varieties might not be greatly reduced.

NATIONAL STANDARDISATION

The establishment of a national standard in a case like this is, of course, very much more difficult than fixing a standard for a single organisation. A much greater variety of uses and methods of manufacture must be provided for. But even if the national standard provides a somewhat wider range of sizes and types of the component in question than would suffice for a single firm, it is only by proceeding to national standardisation that the possibility of cheaper production is brought about. In co-operating in the work of establishing a national standard, each firm using the component would have to balance the advantages of eventual lower cost of the component against the immediate cost of changing certain sizes to suit the convenience of the majority of users. The two points to observe are :—

(*i*) That the further standardisation of bought components is carried out by individual firms, the greater will be the immediate cost of any change of these standards to those firms.

(*ii*) That the greater the agreement nationally on a limited range of standard components, the greater will be the eventual reduction of their cost and consequent increase of productive capacity.

The first of these considerations is definite and calculable by the individual firm, but it is a cost which is only once incurred ; the second depends on the extent to which agreement results in an effective limitation of the range of sizes and types manufactured, not only in drafting the standard but afterwards in making use of it, but the saving in cost is a permanent one so long as the component is used.

We thus see that there is a danger in carrying out simplification by individual user organisations where the component is one which is not manufactured within the organisation. It may make eventual agreement on national standards more difficult, whilst it cannot secure the full economic advantages of simplification.

On the other hand, if the manufacturers of the component decided individually to simplify the range they made, some of the savings in the cost of manufacture and the consequent increase in total productivity might ensue, but the user would fail to gain the advantages of holding a smaller range unless he tied himself to a single supplier. In normal competitive conditions this is less likely to happen than simplification by the user. Manufacturers appreciate

the advantages of simplification, but are not generally in a position to restrict the demands of their customers for a multiplicity of sizes.

THE CENTRAL DIFFICULTY

This brings us face to face with what is perhaps the central difficulty in achieving simplification nationally. Manufacturers, generally speaking, would welcome it. By reducing their costs and increasing their productivity it would greatly improve their competitive position in the export market. But they cannot usually afford to carry it out independently of their customers. The difficulty is to concentrate the demand on a simplified range of sizes.

Users are always, and have always, been represented on B.S.I. committees to the extent that they themselves are willing to respond to the invitations of the B.S.I. for their co-operation. It is not possible, of course, to secure complete representation of the users of such common articles as, for instance, hacksaw blades, on a B.S.I. committee. The problem is, however, not as unmanageable as that would appear to indicate. Buyers of small quantities of a component, though they may amount in the aggregate to a majority of the total usage, do not stand to gain or lose much by a change in sizes which may affect them. It is the large users only to whom a single alteration of a dimension of a small article may mean an initial expenditure of thousands of pounds—and the ultimate saving perhaps of tens of thousands of pounds.

On the other hand, each of the large users is probably concerned with very many components which could with advantage be simplified. Not only, therefore, are they faced with the fact that simplification will probably involve an initial expense and disturbance to their production programme for the sake of future savings, but in addition any one item for which a B.S.I. committee seeks to produce a simplified standard may be only one of a hundred such items in which they are equally interested, so that, unlike the manufacturer, they may feel that the time and cost of their co-operation in so many projects is not justified.

Notwithstanding this, tribute should be paid to the amount of time which many of the large organisations are devoting to this problem at the present time. It is on this co-operation that the future progress of effective standardisation in the direction of simplification largely rests.

The aim of simplification, on which so much emphasis is laid in the Lemon report, not only involves new standards, but also existing standards. A number of B.S.I. committees engaged on the revision of existing standards have had the Lemon Committee's recommendations in mind, and steps have already been taken towards achieving ultimate simplification in a number of revised standards which have already been published.

PROGRESS TOWARD SIMPLIFICATION

The ideal way of achieving simplification would be for all the large users to agree amongst themselves on a restricted range of types and sizes. This would in most cases be a very complex task to undertake in a B.S.I. committee, requiring as it would a good deal of discussion of the domestic affairs of individual concerns. Steps in this direction have, however, been taken by certain large groups of manufacturers who are at the same time major users of engineering components, notably by the automobile industry, which will undoubtedly pave the way for positive measures of simplification in revising existing British Standards. In addition to this, a noteworthy step forward has been the formation of the Engineering Equipment Users Association, which is working in close conjunction with the B.S.I. This Association, comprising certain of the large oil and chemical companies, is tackling just this problem of obtaining agreement amongst groups of large users of engineering products on standards that will best serve their common interests.

It will, however, take a considerable time for agreement on a large range of products to be reached in this way, and in the case of many engineering components in universal use, such a method is not possible. In many cases the only practicable policy is for the B.S.I. to indicate preferred sizes in its standards, and by thus giving a lead to industry, to bring about a concentration of demand on those sizes in course of time. To be effective, this calls for the widest possible use of British Standards and a definite policy of adhering to the preferred sizes whenever possible. There is no doubt that much can be done this way. In the work of the B.S.I. it is no uncommon thing for manufacturers, sitting in committee with representative users, to point out to the latter that they are responsible for the creation of special sizes of a common article for which a standard is to be prepared, and for the user to reply that in the absence of a British Standard range of preferred sizes there is nothing to deter him from demanding any size that may happen to suit his particular convenience at the moment.

Thus a bolder policy of including only a basic range of types and sizes in British Standards might prove the most effective way of bringing about the desired concentration of demand, manufacturers presently justifiably adding to the inducement by introducing a price differential between the sizes listed in the British Standard and all others, which would be regarded as " specials."

The author can think of no instance where such a drastic policy has been as yet carried out in the revision of an existing British Standard for an engineering product. There are, however, many cases such as those already mentioned, where in the revised editions of existing standards certain less frequently used sizes are being

omitted or indicated as not being in the preferred range. This may seem to be an ultra-cautious procedure, but it must be remembered that the B.S.I. must carry industry with it, and what is possible depends ultimately on the willingness and ability of industry to support a bolder policy.

DIFFICULTIES AND POSSIBILITIES

Taking one of the examples mentioned namely ball and roller bearings, a further examination of this case, which figured prominently in the Lemon report, will illustrate very well the difficulties and at the same time the possibilities. The original B.S.292 was drawn up, like so many other British Standards, to cover all sizes and types in common use, the aim being to ensure that the same type and size from different manufacturers would be interchangeable. Amongst other things the standard provided for both metric and inch size bearings.

In the recent revision of the standard it was felt that the first point to tackle was this question of inch and metric sizes, which the Lemon Committee had singled out for comment. The manufacturers were in favour of eliminating one of the two series. The difficulties to be faced were obviously on the users' side, many of whom would have to change long-standing practice and for many years to come face an *increase* in the number of parts to be carried in store. The position for them is thus the exact opposite of that of the firm mentioned in the early part of this paper, who selected a private range of fittings which were in themselves " specials " from the manufacturers' point of view, in order to gain the considerable advantage of a reduction in stock carried. The former users of inch size bearings are being asked to incur the immediate and definite cost of increasing their stock in order to gain in the long run the advantages, to which no definite financial value can yet be attached, of increased productivity and reduction of manufacturing cost. The common national interest thus calls for a far-sighted view of what is to their ultimate advantage, by users ; and a tribute should be paid to those users, who, as in the case of ball and roller bearings, have expressed their intention to follow loyally the recommendation of the revised B.S.292 that metric size bearings should be adopted for new designs in the future.

This example illustrates well the reasons why it is not advisable to go too quickly in this direction. There would be a very real danger that a standard in which too drastic a limitation of sizes had been made might be so far ahead of current practice that it would tend to fall out of use altogether. On the other hand the process of pruning must be a continuous one, and there is little doubt that in the next edition of B.S.292 still further reductions in the types provided for will be found.

CHANGE IN OUTLOOK

The outlook generally on this matter is changing. It is now commonly accepted that in general a British Standard is not the proper place to list "specials," though the necessity of preventing the unlimited growth of specials has to be carefully weighed up. It is easier to approach the drafting of an entirely new standard from this point of view. A very good illustration is to hand in the shape of a parallel subject to that just mentioned, namely plain bearings. No British Standard for plain bearings has ever existed, and the variety manufactured is such that from the point of view of usage any standard must involve a more or less arbitrary choice. Recognising that any projected British Standard will take time to come into general usage, and approaching the problem from the point of view of giving a lead to industry, a new technical committee has been formed to produce standards for machined bearings and wrapped bushes in accordance with a basic list of preferred shaft sizes and with the system of tolerances given in B.S.164—Limits and fits.

This basic list of preferred shaft sizes is to figure in the revision of B.S.164, which is now nearing completion. In respect of bore diameter, both plain and anti-friction bearings will eventually be based on the first choice range of sizes given in that list which will govern all standards associated with shaft sizes. Such standards have to provide for the requirements of the whole of engineering industry, and the nature of the problems associated with the design of shafts, e.g. engine weights, torsional vibrations, preclude limitation involving very wide steps in diameter. In such cases further simplification is possible in particular fields of application. For instance, a standard range of flexible shaft couplings, which may presently be tackled by the B.S.I. would proceed by much wider steps than the basic range of preferred shaft sizes.

Hitherto the work of the Mechanical Engineering Section of the B.S.I. has not proceeded far in the direction of the dimensional standardisation of assemblies of any degree of complexity. It is implicit in the Lemon Committee's report, however, that much more should be done in this direction. It will depend, as already explained, on the extent to which large groups of users can agree on common standards to meet their requirements, and it is of interest to note that with the formation by the B.S.I. of several user industry standards committees, such as the Petroleum Equipment Industry Standards Committee, a great stimulus in this direction has been created. This undoubtedly will lead to increasing standardisation of the principal fixing dimensions and capacities of complex units like pumps, and it is here that simplification can be most effectively secured by a judicious choice of wide steps between successive sizes, rather than by standardising the detailed design of each unit and thus reducing types as in the case of basic components.

CHOOSING A RANGE OF SIZES

The question of how to choose such a range of sizes has been given a great deal of attention in the past, and the B.S.I. has recently issued as B.S.1638 a " Report on the Selection of Ranges of Types and Sizes (Preferred Numbers) " which was prepared by Mr. J. E. Sears. The basis of any normal satisfactory range of sizes is a geometrical progression, each size being a constant percentage increase on the one below. It is obviously convenient that the range of preferred numbers chosen to designate the series of sizes should repeat itself in successive powers of 10, and a number of countries have adopted as standard the use of ranges of numbers based on a common ratio of some root of 10, which are known on the Continent as R series or Renard numbers. The fundamental series has a multiplying factor of the 10th root of 10. If eleven sizes of an article would suffice for a standard range, and if the size of the smallest is expressed as 1 unit and that of the largest as 10 units, then by multiplying successively by $10\sqrt{10}$ a range of sizes is formed which proceed by equal proportionate steps of approximately 25 per cent. Other series based on the 20th and 40th root of 10 give correspondingly closer steps. These series of preferred numbers are known as the R 10, R 20 and R 40 series respectively and every alternate size in the 10-series constitutes a 5-series with steps of approximately 60 per cent.

The Committee which is carrying out the revision of B.S.164 " Limits and Fits," were able to use the 10-, 20-, and 40-series as first, second and third choice sizes for shaft sizes up to $\frac{1}{4}$ inch, but above $\frac{1}{4}$ inch, and especially for the larger sizes, for the reasons already mentioned, the 80-series had to be resorted to, together with arithmetical interpolation, in accordance with prescribed rules, between selected sizes in the preferred number scale.

Although basically very simple in theory, the interpretation of the idea of geometrical series of preferred numbers in actual tables of preferred sizes is complicated by the use of both binary and decimal fractions of an inch, and by the desirability of rounding off or contracting decimal numbers in the various series. These difficulties have been met to some extent by the publication of standards by the old International Standards Association, and by the American Standards Association for fractional numbers. In practice, however, many other considerations affect the actual selection of sizes in a simplified range, and it is generally considered satisfactory if these approximate to one of the Renard series of numbers. For this reason it is thought that the publication by the B.S.I. of a report on the existing standards in the form of a general guide to the selection of ranges of types and sizes will serve the most useful purpose at the present time, and its importance in the general programme of

simplification which the Lemon Committee has set before the engineering industry will be apparent.

SCOPE FOR NEW STANDARDISATION

Turning now to the question of the scope for new standardisation, the Lemon Committee devoted considerable attention in their report to the function of the B.S.I. in regard to the initiation of new standards, and some account of what is being done in this direction may be of interest. In the past it has been the practice of the B.S.I. to initiate new standardisation only upon specific request from a responsible outside source. The process of drafting standards, once they are embarked on, has always been, and still is, by agreement and consent of all parties. That is fundamental to the independent position of the B.S.I. as an autonomous body serving and supported by industry as a whole. But the restriction of the initiation of standardisation to outside initiative has hindered to some extent a completely logical development of standardisation. With the limited resources of the B.S.I. in the past this development has of necessity been governed by its capacity to cope with the work of new standardisation, and in general it may be said that the demand for new standards has always been ahead of this capacity. This is still true today, despite the considerable expansion that has taken place in the organisation, and in view of the peculiar importance of standardisation at this juncture, it is vital that those resources should be used with the greatest efficiency.

With the full co-operation of industry, as exercised through the various industry standards committees, the B.S.I. is taking full advantage of the proposal that it should take the initiative in planning standardisation, and as an example of the advantages of this, I propose to cite the case of valves for steam, water, and gas from our mechanical engineering work.

The preparation of a series of standards for such valves was decided upon by the Mechanical Engineering Industry Standards Committee, after considering a report from a special programme committee which it set up to survey the field of possible standardisation. Other industry standards committees have appointed similar programme committees for the same purpose in their respective fields. The programme committee circulated very widely to industry a request for suggestions as to suitable subjects for new standardisation, and its task was greatly facilitated by the fact that there was considerable agreement on several broad subjects as offering immediate and substantial scope. One of these was valves for general purposes.

CO-ORDINATION OF STANDARDISATION

In the past certain work on valves has been done by B.S.I. committees constituted to meet a special demand for standards for particular types of valves. In the Mechanical Engineering Section there was, for instance, Technical Committee MEE/40 which produced B.S.1218 "Sluice Valves for Waterworks Purposes," and in the Petroleum Equipment Section, Committee PEE/1 was actively engaged in the production of a series of standards for special valves for use in the petroleum industry. The latter Committee had already found that the work done by Committee MEE/40 could be made use of in their own standards, for instance, the standard sizes of square on the spindle to take the hand wheel. Co-ordination where possible was in this way already taking place, but it was obvious that if a systematic programme of valve standardisation was to be embarked upon by a committee representative of the whole field of general engineering users, such co-ordination would be greatly facilitated by ensuring that each feature should be standardised in such a way as to serve the maximum number of types of valves. It will be readily appreciated that the danger of *ad hoc* standardisation of special types is that a standard for some feature common to all valves might be fixed which would subsequently prove to be unsuitable for more general types, whereas a standard for the same feature chosen on a broader basis would be no less suitable for the special valve.

A new Technical Committee MEE/81 has, therefore, been formed to produce a series of standards for valves and as a start are preparing drafts for bronze and cast iron gate, globe and check valves for general purposes. In drafting these standards, the work already done by the Petroleum Equipment Industry has been of the greatest value, and it may be added that representatives of the industry sit on the Committee, thus ensuring that, when these standards are published, they will include provisions that will avoid the necessity for the publication of separate standards for similar valves used in the petroleum industry. When the present drafts have been completed the Committee will proceed to other types of valve, and by working systematically in this way the maximum results can be achieved with the minimum expenditure of time, since each succeeding draft will be facilitated by the work already done on previous drafts.

Another subject which is being tackled in the same systematic way as a result of the Lemon Committee's report, is hand tools. A main Technical Committee MEE/120 has been formed with a number of sub-committees dealing with the various kinds of tools. These sub-committees are grouped in a manner corresponding to the trade associations of the manufacturers, and again the advantages of

systematically tackling a whole series of related standards are proving themselves in the rapid progress achieved.

There are, of course, many examples of such systematic procedure in the past, and I do not want to give the impression that it is only since the publication of the report of the Lemon Committee that such methods have been adopted. Many committees formed in the past have been given wide terms of reference and have been sitting more or less regularly for years producing whole series of related standards. Notable examples are the committees on land boilers, on measuring tools, on wire ropes and chains, and, recently, on cranes and derricks. It is simply in the greater freedom to apply such economical methods of procedure to new subjects or subjects that have only been partially dealt with in the past, that the significance of this particular recommendation of the Lemon Committee lies.

STANDARDS FOR QUALITY AND SAFETY

It will have been noticed that several of the committees who have for years past issued standards comprehensively covering the fields for which they are responsible, are concerned with what are primarily quality or safety standards. In such cases there is sometimes a special incentive which has led to the early completion of comprehensive series of standards, in the shape of statutory safety regulations or the requirements of the insurance authorities. It is noteworthy, however, that such standards have individually in the course of time become far more than a list of requirements necessary to conform to the safety regulations. In some cases, notably chain hooks, the work of the B.S.I. committee has led to research which has subsequently become a universal basis of design. The new revisions, now in the press, of all the British Standards for boilers will include amongst other additions, a series of drawings illustrating typical welding methods for the attachment of standpipes, etc., thus keeping these standards up-to-date as manuals of good design practice, indispensable to designers and users of boilers. Apart from their value to manufacturers, standards of this nature have undoubtedly done much to establish the high reputation abroad of British products in this field.

In the present conditions of export trade, it is probable that the establishment of quality standards and rating standards can in the long run become a no less important aid to the prosperity of the country than the reduction of production costs by simplification, and the new work on hand tools is being pressed forward in this belief. An interesting example of this arose in the case of fork lift trucks. British manufacturers, in the best traditions of our industry, have been in the habit of rating these conservatively in relation to the actual conditions in which they have to work. Oversea buyers

are not slow to appreciate this, but in the absence of a common and recognised British Standard method of rating, it is not easy to convince them of the precise significance of this when comparing the British product with other products of similar capacity, for which greater ratings are claimed. An international standard basis of rating would, of course, seem to be the ideal, but might in practice leave room for differences in interpretation or methods of testing, unless very completely tied up, which would be still more difficult to explain than the present differences. The existence of a British Standard clearly setting out the basis on which the British product is rated has proved in practice, as in the case for instance of pump tests, to go a very long way to giving the British exporter a fair basis on which his products can be assessed in comparison with those of other countries. It has been suggested that similar standards for mechanical handling plant of other kinds would be of equal value, and this is a field in which a systematic programme of standardisation, including rating, might possibly be undertaken.

STANDARDS OF SPECIAL INTEREST TO PRODUCTION ENGINEERS

The last paragraph has touched on the question of international standardisation and I would like to conclude this paper with some remarks on the work of the International Organisation for Standardisation. Before doing so, however, some mention should be made of certain British Standards relating to workshop practice which are of special interest to production engineers. Reference has already been made to the revision of B.S.164, Limits and Fits, in connection with the list of preferred basic shaft sizes which is being introduced into it. In other respects the revision, whilst extending the range of fits, preserves the main principles of the existing standard.

One fundamental improvement which the Committee entrusted with the revision would have liked to carry out is the relation of the various grades of fits set out therein to their function, that is to say, running, location, shrink fits, etc. This might have been practicable for the smaller diameters, but it became evident that insufficient data was available from general engineering practice as regards the larger sizes of shaft and hole, on which to base with confidence any guiding classification. There are, of course, arguments against attempting to do so. The precise fit required depends to a great extent on conditions, especially lubrication, and the user might be presumed to know from experience which grade of fit will best suit his purpose and, therefore, to require no guidance. Whilst this is true in cases of large scale manufacture of such components as bearings, there is no doubt that innumerable cases continually arise in general engineering where the user might reasonably expect B.S.164 to give him guidance of this nature. The absence of such

guidance may lead to unnecessarily fine tolerances being specified on drawings, which tend to be honoured rather in the breach, in the workshop, and may be partly responsible for the limited use of B.S.164. The Committee are fully aware of this and are anxious to secure co-operation from industry in establishing general principles, which with due reservations as to the effect of particular conditions, can be put forward with confidence for the guidance of the user confronted with the problem of choosing a fit for a particular purpose and having no previous experience to guide him.

In any work of this kind which affects the whole field of engineering, it is very difficult to constitute an adequately representative committee, and it is all the more important, therefore, to have comments and views from practical engineers. These need not be confined to the period during which a draft standard is formally circulated for comment. Standards of this nature are constantly under review and comments arising from their use or non-use are at all times of the utmost value in ensuring that the standards concerned shall best serve the needs of industry.

MEASUREMENT OF SURFACE TEXTURE

Another standard relating to workshop practice which may appropriately be mentioned is that dealing with the measurement of surface texture. This has taken a long time to complete owing to the intricacy of the subject and the constant development in the technique of measurement, but its publication is now imminent and it is hoped that it will be a useful guide to industry. It should be made clear that the use of British Standard Index Numbers for surface finish is not intended in normal cases where surface finish does not play a vital part in the functioning of the component concerned. In most cases the normal markings on a drawing to indicate the broad category of finish required will continue to be used. Misapprehension on this point might lead to mistaken criticism that the standard is too detailed and scientific for everyday use. For such a purpose the only practicable standard is a sample of the surface required, as there is no simple empirical method of specifying surface finish.

British Standards relating to gauging methods and principles are also under revision, and those covering commonly used tools such as drills, reamers, milling cutters, etc. are being systematically brought up-to-date. This is all vital work in providing manufacturers with the means of producing and maintaining products of a uniformly high quality.

Turning now to the field of international standardisation, some explanation must first be given of the significance of the change which has taken place in the international organisation responsible for this work, and the relationship of this country and America to it. Certain fields of international standisation in which this country has

long taken a prominent part, such as that falling within the province of the International Electrotechnical Commission, are continuing under the same auspices but in close association with the International Organisation for Standardisation. International standardisation in the field in which the production engineer is mainly interested was formerly carried out by the International Standards Association, in the work of which this country and the U.S.A. took only a limited part.

The natural tendency was for standards produced by the former I.S.A. to become associated particularly with the metric system. Some dimensions in these standards, e.g. shanks for pneumatic tools, are actually inch dimensions in origin, the influence of this country's former predominant position in manufacture still being very marked in Continental practice. Nevertheless the Continental desire to round off to tidy numbers, and the addition in modern times of specific tolerances to basic dimensions, has tended to cause even these standards to deviate slightly from the corresponding British Standards, a particularly exasperating state of affairs to exporter and user alike.

At the close of the Second World War, with the attempt to establish a stronger association between the nations in all matters relating to trade and culture, it was decided that the work of international standardisation should be entrusted to a new organisation entitled the International Organisation for Standardisation (ISO) in which both this country and the U.S.A. should take an active part. It was agreed that the work should take as a basis the organisation into technical committees, and the standards already established by the old organisation where appropriate, but a fundamental change was made in that the international body was charged with the making of recommendations only, the actual promulgation of these recommendations in the form of standards being left to the various national standardising bodies who as member bodies of the ISO would be expected to implement them as far as possible.

Participation in the work of any particular international technical committee is left to the decision of the appropriate B.S.I. technical committee which also acts as the British national committee for the conduct of the work, but in principle the General Council of the B.S.I. favours participation.

B.S.I. CO-OPERATION

Many of our B.S.I. technical committees have already taken an active part in the work of the international organisation and it has become apparent that the present is an exceptionally favourable opportunity of influencing the trend of this work, and of correcting tendencies towards increasing deviation between British, American and

Continental standards. There have been many technical developments since 1939, when the work of the old International Standards Association ceased. The time is therefore ripe in any event for complete revision of many of the old ISA standards. Since the war the revision of most of our key engineering British Standards has been or is being undertaken, and our Committees in consequence find themselves in a very favourable position to make proposals for such revisions, particularly in the case of standards relating to machine tools and small tools. The Continental countries have also shown willingness to go a long way to meet these proposals, provided they can feel that there is a readiness to make adjustments on our side also.

There is, of course, a much more difficult situation in regard to the fundamental standards for screw threads and bolts and nuts. With the agreement on the unified screw thread, however, the inch-using countries are, at any rate as regards threads above ¼ inch in diameter, in the position of having resolved their own differences. Moreover, the ISO Committee have formally agreed to adopt the thread profile of the unified screw thread as an ISO recommendation. To obtain a world-wide standard, therefore, it now remains only to reconcile the metric and the unified pitch-diameter series.

This last step in the process of world unification will perhaps prove to be the most difficult, but the B.S.I. has been at pains to reduce those difficulties by presenting the unified pitch-diameter series in B.S.1580 in both the metric and inch systems. In these days when actual engineering measurements in precision work are necessarily in small fractions of the common unit—thousandths of an inch, for example—the advantage of a round figure is largely illusory. From other points of view such standards can equally well be expressed in either system. If the ISO can succeed in dissociating absolute dimensions from particular systems of measurement it will have taken the main step necessary to surmount these difficulties.

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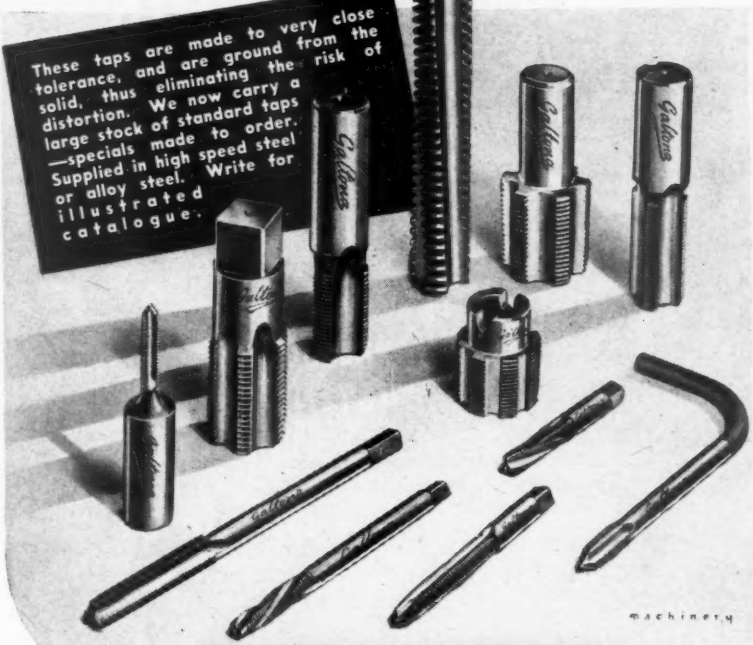
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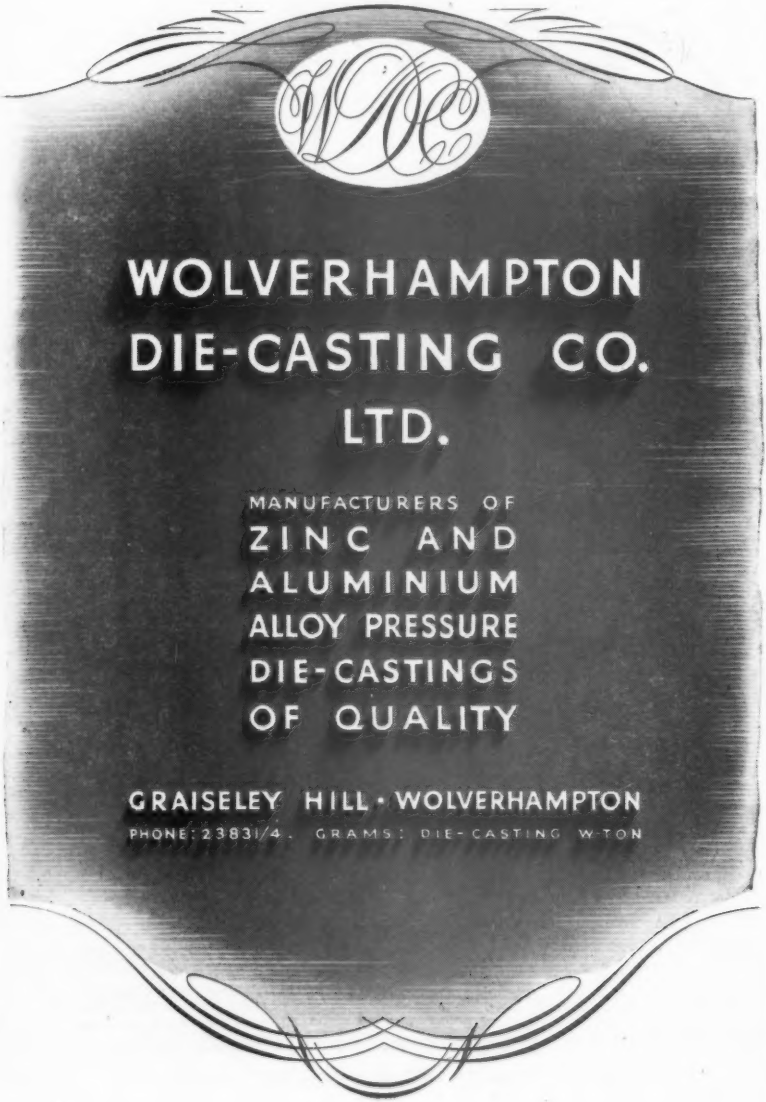
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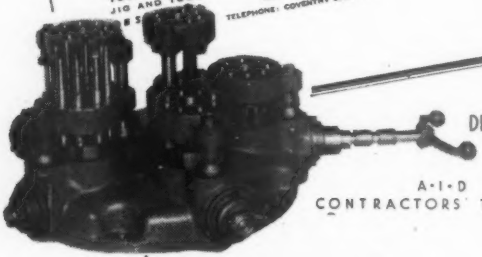
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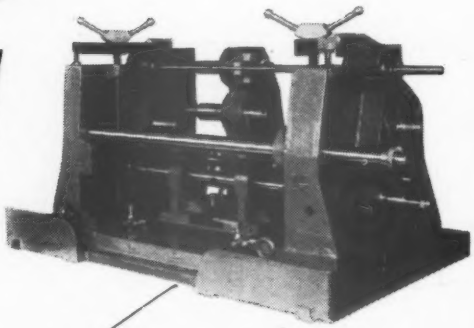
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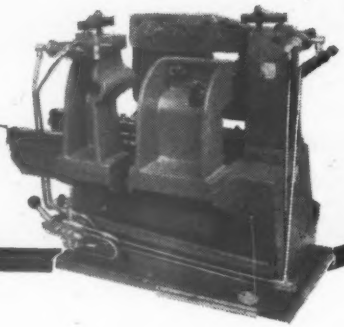
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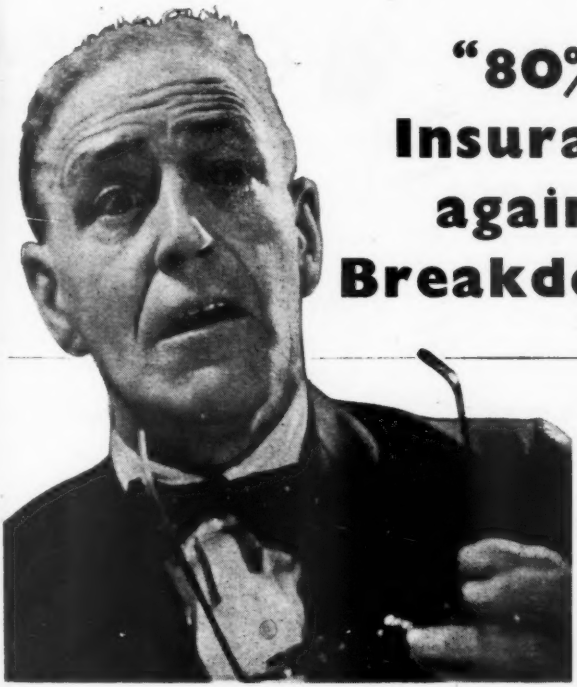
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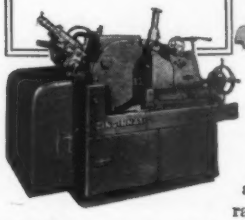
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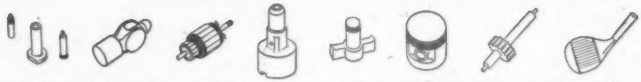


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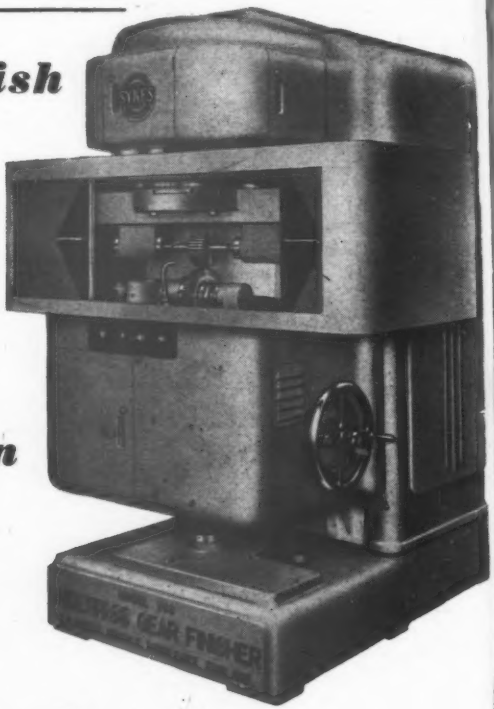
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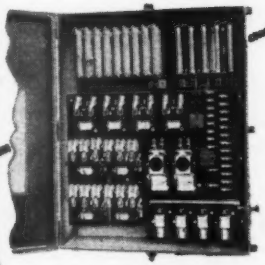
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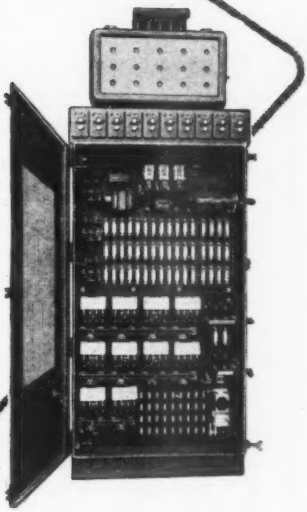
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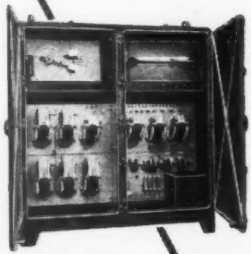
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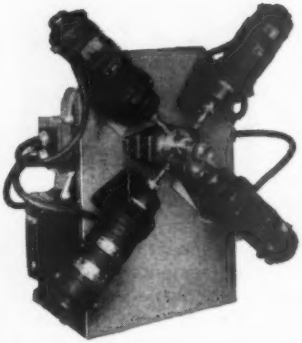
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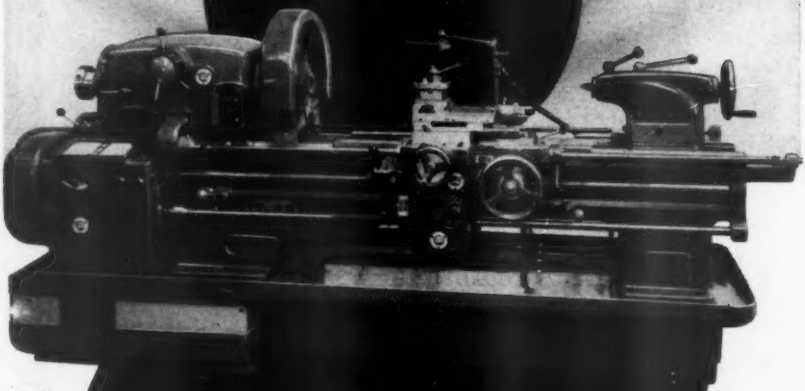
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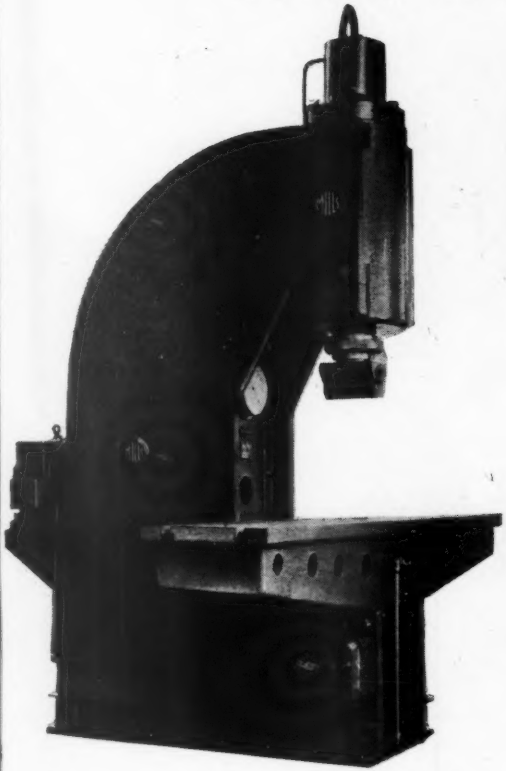
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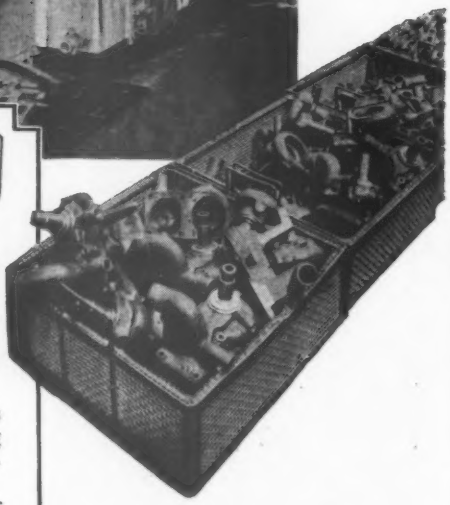
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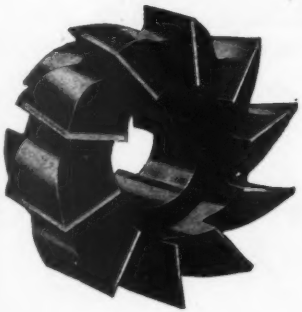
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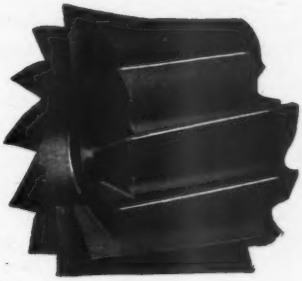
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SLOTTING CUTTERS 2½" to 6" dia, x ¼" to ½" thick.
SHELL END MILLS 1¾" to 3" dia.
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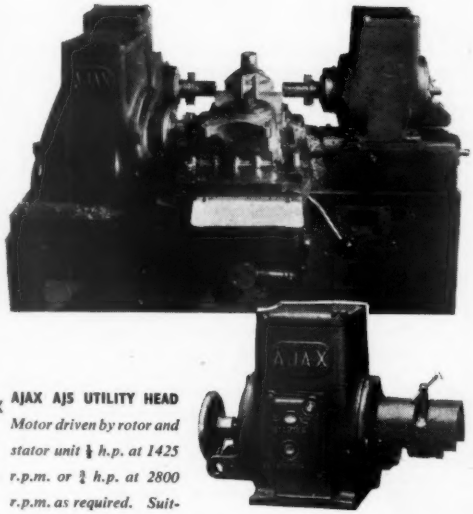
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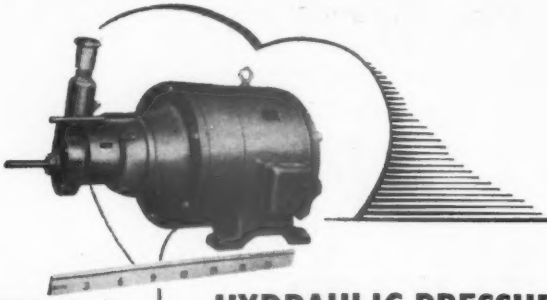


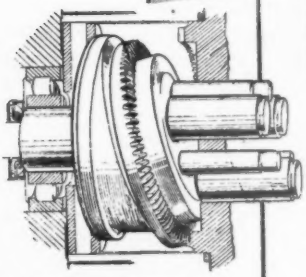
★ **AJAX AJS UTILITY HEAD**
Motor driven by rotor and stator unit ½ h.p. at 1425 r.p.m. or ¾ h.p. at 2800 r.p.m. as required. Suitable for 400-440 volts 3ph. 50 cycles. Height of motor centre: 4½ ins. A 3 ins. dia. 3-jaw self-centring chuck is standard (4 ins. dia. chuck supplied if required). Alternatively, can be supplied with lever-operated collet mechanism, to take work up to 1½ ins. diameter.

Three AJAX motorised Utility Heads go to make up this efficient, accurate and economically constructed special-purpose machine tool. Each simultaneously bores a 2" hole and surfaces a boss, the table being hand-traversed for the two boring positions. Note the oblique setting of the foremost Head. This simple set-up rapidly and consistently machines light alloy castings in 160 seconds floor-to-floor time. During the traversing time on these operations, the operator is engaged on a similar component using an AJAX sensitive drilling machine.

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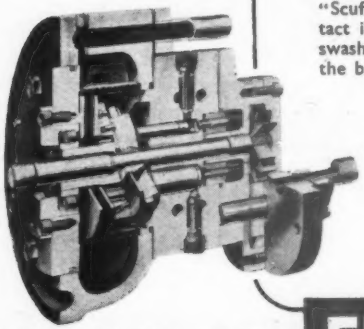
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97% VOLUMETRIC EFFICIENCY



★ Showing the geared mechanism which constrains the swash-plate to revolve at the correct speed to avoid "scuffing" of wobbler and plunger ends.

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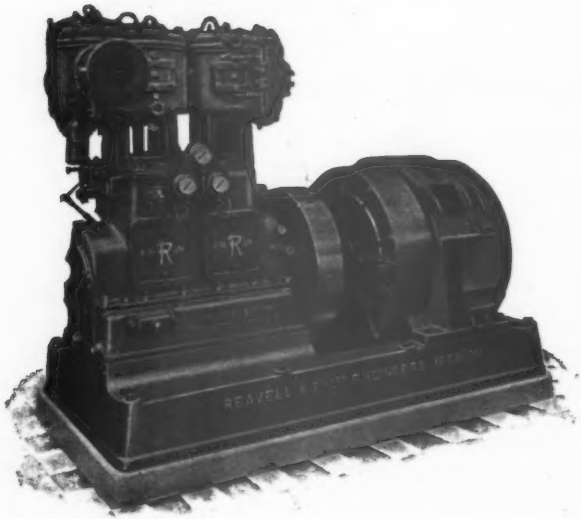
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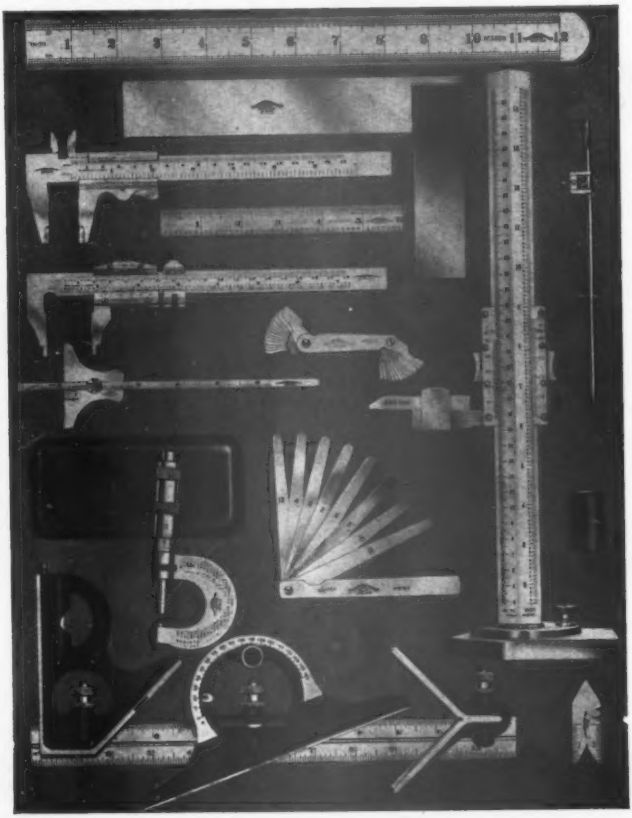
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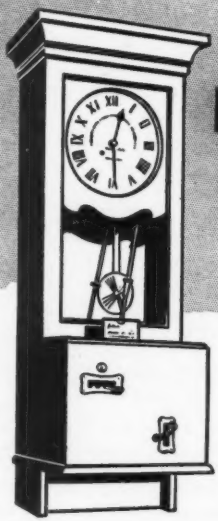
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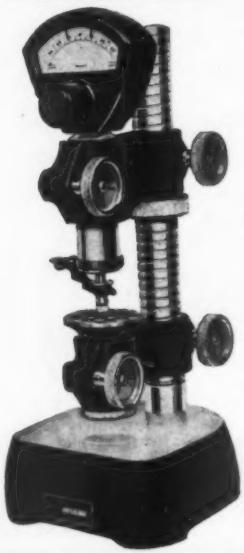
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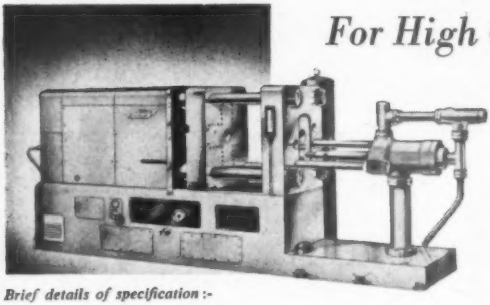
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DIE-CASTING MACHINE

Brief details of specification :-

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Plunger diameters ... ... 1¾ to 3¼ ins.
Pressure on material ... 6,150-23,000 lbs. sq. in.
Locking pressure ... ... 450 tons
Platen dimensions ... ... 35½ x 35 ins.
Maximum die space ... ... 25 ins.

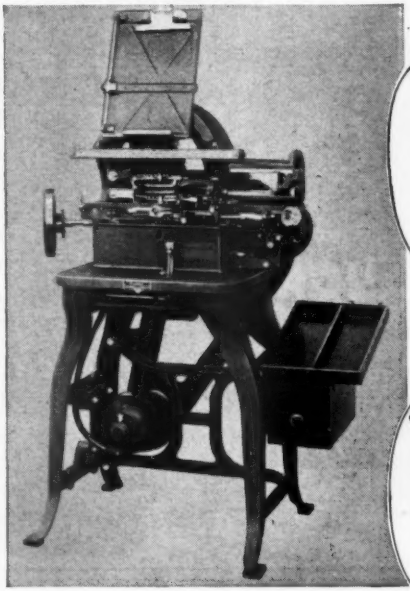
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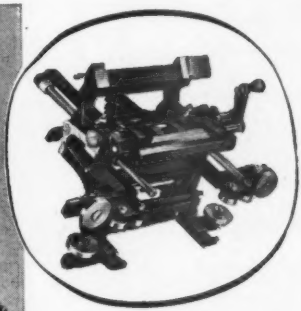
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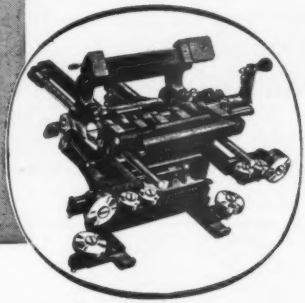
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ZINC ALLOY DIE CASTING makes a difference!

Difference to what? The inset photograph shows an assembly of six zinc alloy die castings; below it is a sketch of the old model using iron, brass and gun metal castings. They look much the same, but which would you rather buy?

When the makers of the addressing machine adopted zinc alloy for the plate holding mechanism, they exchanged 35 machining operations for five in one component alone — with a cost reduction of 75 per cent! The other five die castings each effected savings of 25–50 per cent. In addition, the exact dimensions of the die castings made assembly easier, and their fine surface has smartened the product.

Some facts about zinc alloy die casting

Speed of production is an outstanding feature of the die casting process — the shortest distance between raw material and finished product. Zinc alloys are the most widely used of all metals for die casting because they yield castings with the following qualities:

ACCURACY: Castings can be made practically to finished dimensions and need little or no machining.

STRENGTH: Good mechanical properties for stressed components.

STABILITY: Close tolerances are maintained throughout the life of the casting.

British Standard 1004

It is essential that alloys conforming to B.S.1004 should be specified for all applications.

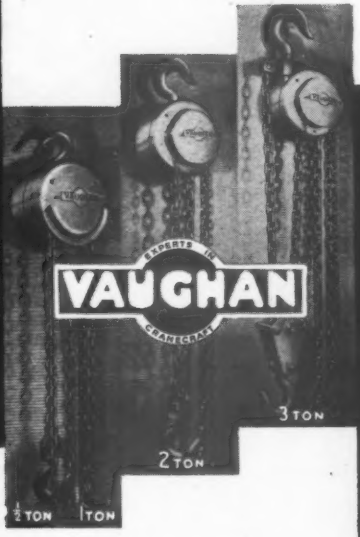
The Association welcomes enquiries about the use of zinc alloy die castings. Publications and a list of Members are available on request.

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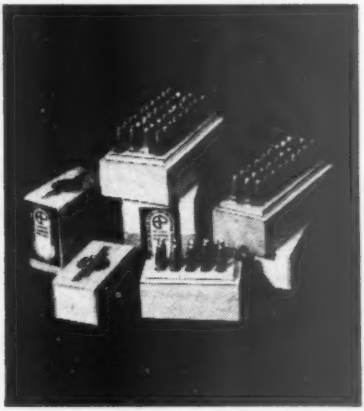
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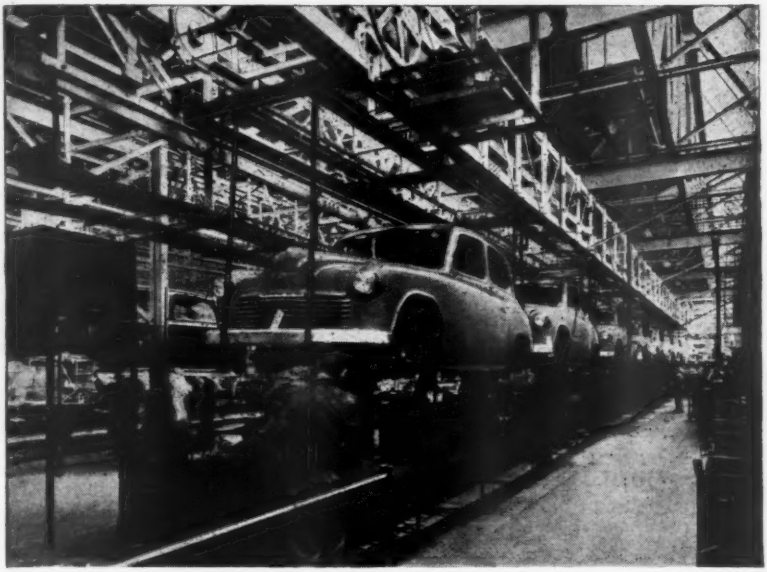
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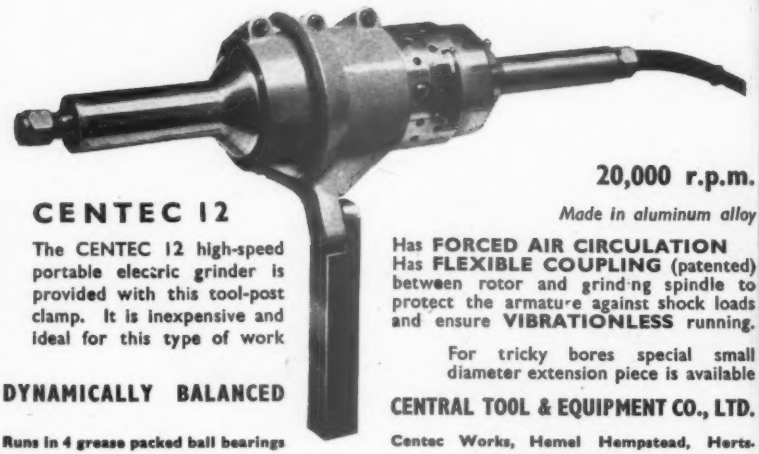
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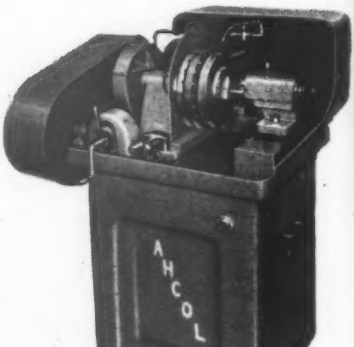
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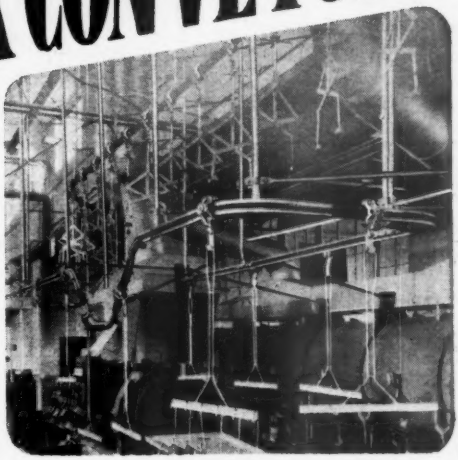
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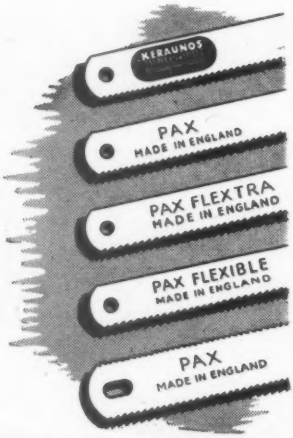
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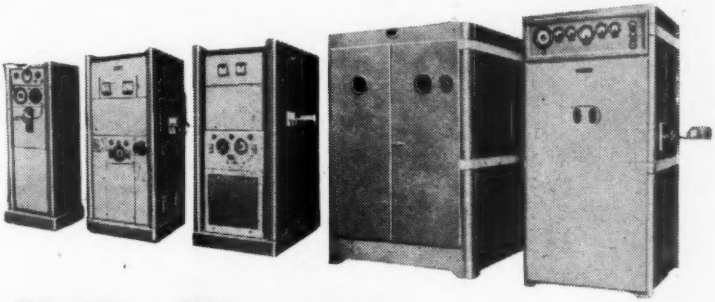
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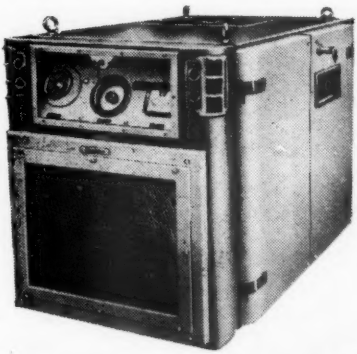


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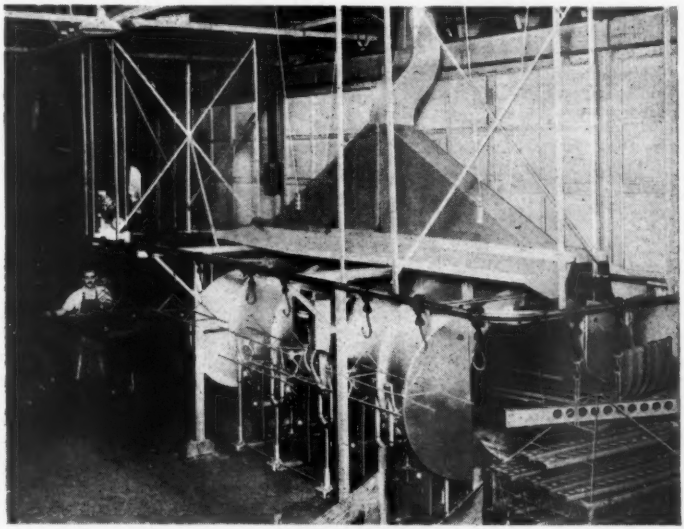
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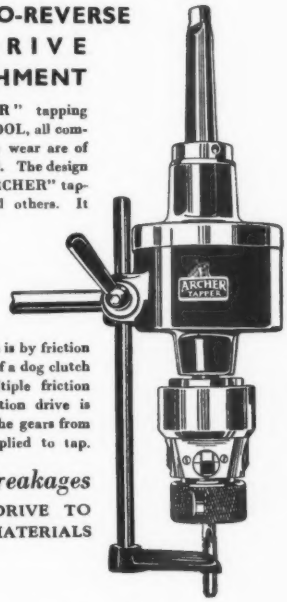
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